Capital Flows and the Macroeconomy: Key Drivers, Impacts, and the Role of Monetary Policy

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Award date:
2020

Awarding institution:
University of Bath

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A thesis submitted for the degree of Doctor of Philosophy

University of Bath

Department of Economics

January 2020

Signature: Date

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Acknowledgements

First of all, I praise and thank Allah SWT, the Almighty, the greatest of all, for His blessings and guidance throughout my life.

After a long and challenging journey that requires a strong commitment, dedication and hard work, I would like to take this opportunity to express my appreciation to all the people who inspired, supported and helped me during the entire process of my studies.

My profoundest gratitude goes to my first supervisor, **Professor John Hudson**, who passed away when I was on my half-way of this academic endeavour. I feel very lucky to have him as my supervisor during my first two years. His dedication, passion for research, and generosity have touched me very deeply. My special appreciation also goes to my next lead supervisor, **Dr. Bruce Morley**, who was also very generous with his time, very supportive and helpful in guiding me throughout my study. He motivated me and monitored my work tirelessly, and at the same time helped me to keep up my optimism and spirit during the hard times. I am also grateful for having **Professor Christopher Martin** as my second supervisor, who would make a time between his tight schedule to meet me. I thank him for all the continuous support, valuable ideas and discussions.

I also have great pleasure in expressing my profound thanks to my examiners, **Professor Eric Pentecost** and **Dr. Nikolaos Sakkas** who have taken the time to examine my thesis and provided constructive comments, advices and suggestions to enhance my thesis. During the viva process, I also thank **Dr. Kerry Papps** who was willing to be the chairman on the examination day.

I sincerely indebted to my sponsor and employer, **Bank Indonesia**, that has given me the opportunity to pursue my doctoral degree and supported me financially.

I am eternally grateful to my parents, **Mr. Husin Kurniawan** and **Mrs. Kartimurti** for their endless love, support and continuous prayer in every steps of my life. My exceptional gratitude goes to my husband and my daughter, **Bagus Susanto** and **Aleesha Kimberley Arsanto,** for the limitless support, patient, sacrifices and compromises that have been made to make this dream came true. Without you, this work would not have been accomplished. Also, to my only brother **Ayatuhaedi Krismanto,** who I can always rely on during difficult times. I also appreciate all my PhD colleagues and academic staffs at University of Bath that I could not mention here individually.

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Abstract

This thesis focuses on the potentially important role of capital flows on macroeconomic performance and monetary policy setting in emerging and advanced economies. The chapter begins with an explanation of the main causes of capital inflows, as it is crucial to the policymakers when constructing an effective policy framework. This chapter contributes mainly by applying different estimation techniques and disaggregating the different types of capital flows. The potential heterogeneity across flow's components is accounted for by the SUR estimation. This study has found that country-specific factors have an important role for capital flows into emerging economies, whilst in advanced economies, the inflows can be closely associated with global indicators. Moreover, each type of flows is driven by different sets of indicators. These findings confirm the relevance of disaggregating the sample and components of the inflows.

The next study is focused on how capital flows may affect an economy. The main contribution lies in the SVAR model construction, which modifies the multiple-country SVAR model by Dungey and Fry (2000) by taking into account the influence of the foreign and domestic capital flows and concentrating the analysis on two countries. This study observed a significant spillover-effect from the US and Japan's capital flow shocks to Indonesia's capital flow expansion, specifically on the direct and portfolio investment flows. Moreover, the exchange rate consistently appreciates in response to a domestic flows shock. Additionally, Indonesia's economy is more responsive to domestic flow shocks in the Indonesia-US model, but less responsive in the Indonesia-Japan model.

Finally, the thesis examines the potentially important role of capital flows on monetary policy setting in IT countries, which has been the most valuable contribution of this study. We extend the Taylor rule in Taylor (2001) by accommodating the capital flow dynamics in the interest rate setting. The non-linear model allows us to identify the response of the policymakers during extreme and normal capital flow periods. Overall, the results confirm a potential to involve capital flow dynamics as an alternative policy rule in both emerging and advanced economies.

Chapter 1. Introductory Remarks

Economic integration in the era of financial globalization has led to increasingly borderless capital flows between countries over the last few decades. Over the last 30 years, we have witnessed several episodes of large-scale cross-country capital mobility around the two major economic crisis periods which has increased the vulnerabilities of the international financial system. The shifting from a rule-based policy towards unconventional policies in the aftermath of the global financial crisis (GFC) in many advanced economies is believed to be one of the crucial factors (Taylor, 2013b). These experiences have been one of the critical points that have raised policymakers' awareness of capital movements.

The quantitative easing (QE) program by the Federal Reserve in the US in 2008, followed by the Bank of England and Bank of Japan for example, led to significant reductions in the long-term yields in many developed countries. Accordingly, this policy has been associated with outward investment flows from some advanced economies. In the latter period, as the global economy has entered the recovery phase, the recent taper tantrum in 2013, when the Federal Reserve suggested the possibility to reduce its bond purchases earlier than expected before, following tapering in the US, suggested that the normalisation of unconventional monetary policies in advanced economies has started to take place. As predicted, the US government bond yields rose steeply (Sahay et al., 2014). The receiving countries have concerns about the ending of these inflows, which next triggered a substantial increase in the volatility of their capital flows, exchange rates and stock market prices. This has led the policymakers, particularly in emerging economies, to pay more attention to the possibility of capital flow reversal and currency depreciation. Given these experiences, recognizing the risk that may come from the volatile characteristics of capital flows has been one of the main motivations for the existing research in this area.

In general capital inflows may bring some benefits to the receiving countries. The IMF, (2016b) among others, discussed some advantages arising from foreign direct investment (FDI) for example, which may include new technology and management practices, as well as financing more productive investment, and generating the "collateral benefits" like financial sector development, trade and economic efficiency. The OECD (2008) also pointed out that FDI can encourage financial stability, economic development, as well as boost public welfare. Moreover, portfolio investment can also help to promote deeper domestic capital market development.

However, capital flows can also come with some risks, which possibly brings new challenges for the policymakers, as they may endanger the domestic macroeconomic and financial stability. The substantial changes in capital flows have often been associated with rising risk due to its volatile characteristic. The challenges from this volatility need to be managed to minimize their risks. For example, Calvo et al. (1996) suggested that large capital inflows may bring less desirable macroeconomic effects such as rapid monetary expansion, inflationary pressures, as well as putting more pressure on the real exchange rate and current account deficits. In addition, Sarno et al. (2016) suggested that the domestic economy may suffer from high interest rates, sharp depreciations and slower growth as a consequence of a sudden decline in capital flows. In addition, the risks can also be increased by shortcomings in domestic financial and institutional development. Consequently, financial system stability is harder to achieve. Thus, the conduct of monetary policy and liquidity management becomes more complicated. In line with this view, Rey (2013) pointed out that capital flows can cause difficulties in macroeconomic management and undermine monetary policy independence, although the countries may have a flexible exchange rate policy.

Managing the benefits, as well as minimizing the risks from capital flows are essential for the policymakers. In line with this, an investigation on the major drivers of capital inflows is a crucial initial step. It is necessary to identify the root cause of cross border capital movements in order to design the optimum policies. In other words, by identifying the main determinants of the flows, it can help the authorities to understand their behaviour, which can further assist in the construction of an effective policy mix to safeguard the stability of the financial system. For example, when the pull factors are indicated as the main determinant of large capital inflows, the policymaker may choose to enhance their macroeconomic policies and macroprudential measures. On the other hand, if push factors show a stronger influence, the authorities may adjust their financial account management to deal with these drivers (ECB, 2016). Nevertheless, a combination of policies between macroprudential and other policies might be considered to deal with the possibility of the transmission of an unfavourable shock between countries.

Furthermore, the literature has highlighted characteristic differences between capital flow components. For example, direct investment, which is commonly associated with a steadier type of flow, has different properties to the banking flows (which is part of other investment), that are generally categorized as the most volatile flows. Related to this concern, chapter 2 of this thesis explores several factors that possibly most influence the

capital flows into emerging and advanced countries. This chapter contributes to the existing literature mainly by focusing on the estimation technique that is different from the approaches used previously. In this study, the potential heterogeneity between different types of capital inflows is considered by applying the fixed effects (FE) with seemingly unrelated regression (SUR) method. This approach is designed to estimate the models taking account of residual correlations, which might come from the natural relationship of the different types of flows (direct investment (DI), portfolio investment (PI) and other investment (OI)). The last flows type, according to the IMF data, contains components including banking flows, derivative transactions and trade credits.

Once the main drivers of capital flows have been recognized, it is also important to study how the flows may affect the domestic economy in the receiving countries. Understanding the impact of the flows can help the policymakers to better mitigate and manage the macroeconomic and financial-stability risks associated with the capital flows, particularly when they are unexpectedly large and volatile. The IMF (2018) among others, highlighted some policy mix to mitigate the impact of disruptive capital flows and prevent the build-up of systemic risk like macroprudential policies, capital flow management measures and foreign exchange (FX) intervention, in addition to macroeconomic adjustments and structural policies. An analysis of possible short-term impacts from the massive capital flows is conducted in Chapter 3. This study focuses on some major macroeconomic impacts in Indonesia, as one of the small open economy countries that has experienced large episodes of capital inflows. The main contribution of this chapter lies in the application of the recent two-country SVAR framework that accommodates capital flows from two separate sources. In constructing the models, this study modifies the multiple-country SVAR approach by Dungey and Fry (2000), by taking into account the influence of the foreign and domestic capital flow variable and concentrating the analysis on two countries. The current literature in this area has been focusing on the single-country SVAR method, such as in Raghavan et al. (2014) and Hwa et al. (2017) for the case of Australia and Malaysia respectively. In Indonesia, a similar approach has been applied by among others Jayasuriya and Leu (2017) and Simorangkir (2006). In our two-country SVAR model, the influences of US and Japan as Indonesia's main trading partners are taken into account, allowing for a spillover analysis from capital flows shocks.

The last empirical chapter in this thesis is focused on the monetary policy rule that incorporates capital flows as the main contribution to the literature. This chapter particularly analyses the central bank reactions to capital flow dynamics, by extending the

existing Taylor rule as in Taylor (2001) with the inclusion of capital flow dynamics. To the best of my knowledge, to date, the existing studies have been focusing on the issues of policy rule in relation to the exchange rate, asset prices, wealth indicators, interest rate spreads or risk aversion in the financial market, such as in Bernanke and Gertler (2000), Taylor (2001), Chadha et al. (2004), Aizenman et al. (2008), Bekaert et al. (2013), Wang et al. (2016) and Dağlaroğlu et al. (2018). Moreover, this study also captures the behaviour of the policymakers during extreme periods of capital flows, as well as over normal periods, in order to see whether the central banks respond differently during both conditions.

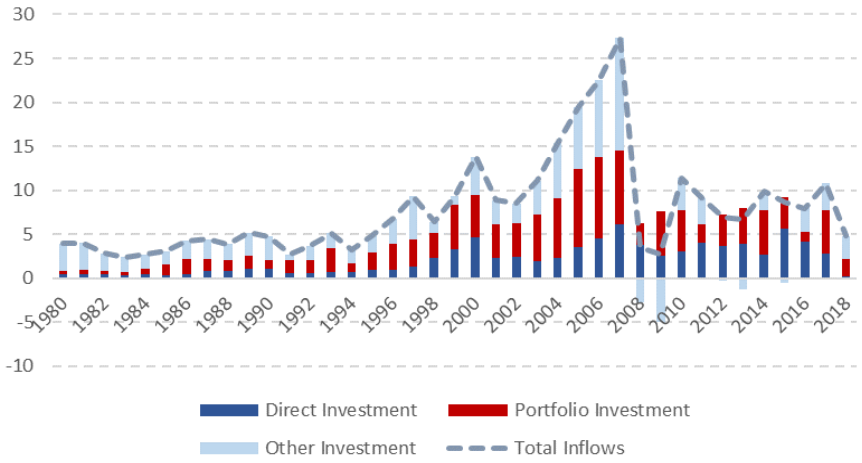
As has been emphasized by the ECB (2016), there was an increasing volatility in capital flows, particularly over the crisis periods. The historical data also shows a shifting of capital movements between emerging and advanced economies around the unstable times. It is common wisdom that cross-border investment tends to be larger in countries with more stable financial and institutional development, where they are assumed to be a safer place to invest. Figure 1-1 displays capital inflows into advanced and emerging economies as a percent of GDP[1], based on the IMF and World Bank database.

The sharp decline in capital inflows into emerging economies following the economic crisis in Asia during 1997-98 is more obvious when focusing on the South East Asian countries as displayed in the last graph. This data supports the IMF (2018) which suggested that following this crisis, the aggregate capital flows to advanced economies have decreased, whilst the flows to emerging economies have appeared to be more persistent. Given this data, the analysis in this thesis involves disaggregation of the sample set. Therefore, in addition to the aggregate sample, the discussion in Chapter 2 and Chapter 4 also covers the emerging and advanced economies as a sub sample.

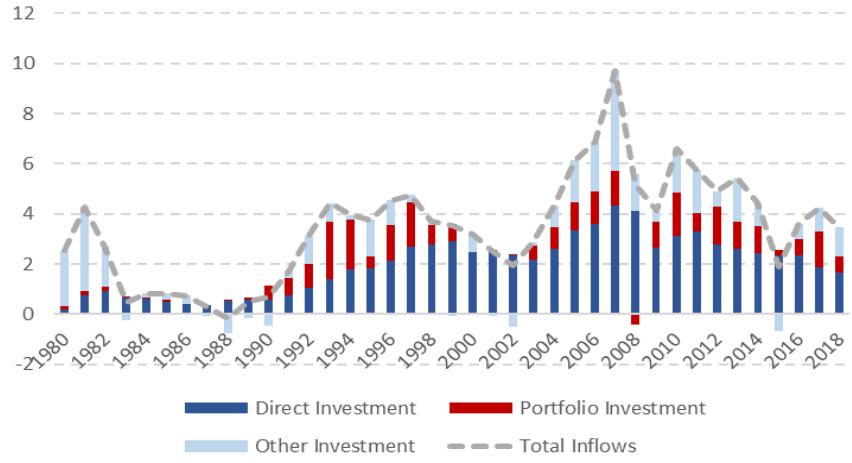
[1] The graph depicts the amount of capital inflows (in percent of GDP) from 141 advanced countries and 36 emerging countries (based on the availability of capital flows data). The South East Asian emerging countries covers Cambodia, Cambodia, Timor-Leste, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. Total inflows refer to the summation of direct investment, portfolio investment and other investment flow in each group of countries.

Figure 1-1 Capital Inflows into Advanced and Emerging Economies (% GDP)

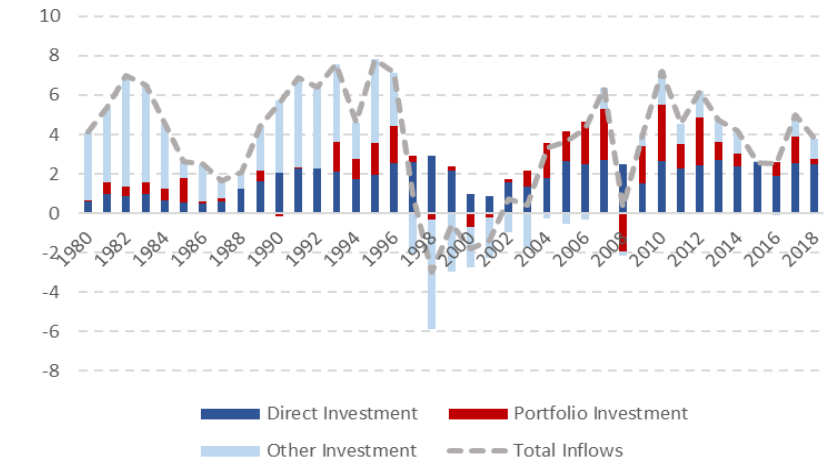
Advanced Economies



Emerging Economies



Emerging South East Asia



Source: Balance of Payments (IMF), World Development Indicators (WDI), Author's calculations

This thesis consists of five chapters. Subsequent to the introduction, there are the three empirical chapters related to capital flows analysis, followed by the conclusion in the last chapter. Chapter 2 explores the domestic and global key drivers of capital inflows into emerging and advanced economies. Chapter 3 discusses the impact of capital flow shocks in a small open economy like Indonesia. Chapter 4 is dedicated to exploring the possibility of accommodating capital flow dynamics in an augmented Taylor rule model. Here the responses of the policymakers to the flow shocks are studied based on historical data from the inflation-targeting countries. Finally, the conclusions and policy implications based on the empirical findings are presented in Chapter 5.

Each empirical chapter can be briefly described as follows. Chapter 2 investigates the key drivers of capital inflows based on pull and push factors, using an extensive panel data of 92 countries during 1990-2015. Discussions on the capital flows have emphasised the importance of identifying the main determinants of capital inflows, as well as understanding their behaviour. This critical step is expected to assist in the construction of an effective policy mix, particularly when facing the challenges from massive and volatile capital inflows. To meet the research objective in this chapter, the capital inflows data is measured using the gross approach, which refers to the total flows on the liabilities side of the Balance of Payments ("foreign-owned") investment. The gross approach allows us to observe the behaviour of foreign investors, which can be dissimilar to local investors. The contributions to the literature in this chapter, are the use of an alternative estimation approach, the disaggregation of the data into different types of capital flow in conjunction with the analysing of gross capital inflows in two groups of economies, in addition to the extended dataset. As potential heterogeneity may arise between diverse types of inflows, the SUR approach is used in the estimation at the disaggregate level for DI, PI and OI. Moreover, a disaggregation is also applied in the sample, as the historical data indicates that there are disparities in the structures and proportion of capital inflows between emerging and advanced economies. Therefore, two dimensions of disaggregation in this study provides a thorough analysis to enrich the existing literature that typically focuses on the determinants of one of the mechanisms applied with a smaller sample size. The test result at the disaggregate level confirms the heterogeneity between different types of flows, which verifies the use of our FE with SUR approach. Overall, while DI and PI flows indicates a closer link to the pull than the push factors in all sub samples, OI flows show a more diverse result. The estimation outcome also suggests that different types of flows are driven by different sets of indicators, although we can still see some common indicators across the flows. The most important variables for DI flows, for example, are the financial

openness, financial market development and VXO. These last two drivers of DI flows, in addition to debt, are also significant for PI flows. Whilst for OI flows, domestic GDP growth and VXO are the most substantial effects. These findings imply how significant the global volatility indicator is as the most consistent driver of all types of flows. Moreover, comparing between the two groups of countries, we notice that in contrast to advanced economies, aggregate inflows in emerging economies have a stronger connection with domestic factors and limited association with global indicators.

Chapter 3 examines how a small open economy like Indonesia responds to capital flow shocks. In other words, this study intends to find whether the foreign influence matters for Indonesia's economic performance. This study utilizes quarterly observations over 1990q1-2016q4. The historical data of the cross-countries capital movements indicates that Indonesia has been one of the main foreign investment destinations in emerging economies. The contributions to the literature include the use for the first time of the modified multi-country SVAR on this capital flow model, and the analysis of alternative types of shock, in addition to the extended dataset. Focusing on the influences from the US and Japan as two of the main trading partners of Indonesia, a two-country SVAR model is constructed by taking into account the capital flows indicator in the model. This is done by modifying the multi-country SVAR model developed by Dungey and Fry (2000). Under this approach, we are able to analyse the impact of two sources of shock on the local economy: (i) the foreign flows shock (spillover impact); (ii) domestic flows shock. For comparison, the typical single-country SVAR model that considers some global variables is also estimated. The model is developed following the main assumption of block exogeneity used in previous studies. Hence, applying this assumption, this analysis presumes that only global variables can influence Indonesia's economy, and there is no feedback impact from Indonesia's economy to the international sector. To apply this assumption in the estimation, some restrictions are imposed on the matrices. Due to the limited number of indicators adopted in these models, the spillover impact analysis is focused on the rupiah exchange rate and domestic capital flows. Whilst in the single-country SVAR, a larger set of variables are included, as it is using only one country. Considering the influences of global variables under a single-country SVAR model, the shock on domestic capital flows is considered to affect domestic GDP, inflation, interest rates, exchange rate and the credit contemporaneously. Next, to see if there are any differences across capital flow components, the flows will be disaggregated into two categories: the direct and portfolio investment flows and other investment flows. This disaggregation is considered due to the different characteristics between both flows. The estimation result indicates that: (i) under

the single and two-country SVAR approach, the Rupiah exchange rate has been consistently appreciating in response to a domestic capital flow shock. This finding is confirmed for the aggregate and direct and portfolio investment flow estimations; (ii) focusing on the domestic flow shock impacts, Indonesia's economy is more responsive to the shock in the Indonesia-US model and less responsive in the Indonesia-Japan model; (iii) while there is no clear spillover effect found in the aggregate level, some significant effects are obtained from the disaggregated flows estimation, specifically from the direct and portfolio investment flows in both of the two-country SVAR models, suggesting a noteworthy consequence of the disaggregation.

Chapter 4 explores the effects of accommodating the influence of capital flow dynamics explicitly into the augmented Taylor rule, as an alternative monetary policy setting in the inflation targeting (IT) countries. This study is conducted following the suggestion from Taylor and Williams (2010) who indicated the need for alternative policy rules through involving the international linkages of monetary policy and economies. There has been limited assessment on the explicit role of international linkages through capital flows in the policy decision to date, as most literature generally discussed its indirect effect via exchange rate pass-through. In this chapter, the contributions to the literature include extending the augmented Taylor rule in Taylor (2001) by taking into account the capital flow dynamics in the model, this is for both emerging and developed economies, as well as the different types of capital flow. In addition, I have used a threshold approach to determine if there are any differences between normal and extreme capital flows and a Bayesian approach to estimating this model. The sample consists of 34 Inflation Targeting (IT) countries over the period 1990-2018. As interest rate smoothing is considered in the model, the Arellano-Bond estimator is applied to estimate the dynamic panel model. In order to capture the interest rate setting behaviour of the central banks during extreme capital flow periods, I set two thresholds which correspond to the upper and lower bands of the flow values. This approach allows us to classify the observations into excessive periods (beyond the threshold values) and normal periods (within the threshold values). The main findings can be summarised as follows: from the non-threshold models, the results suggest that the interest rate setting in all IT countries are significantly influenced by both capital inflows and outflows. Focusing on the threshold models, different findings are obtained between the two economies. In emerging markets, the policymakers are responsive to both capital inflows and outflows. This response is evident during the extreme and normal capital flow periods. In contrast, the central banks in advanced economies show a more limited response, as they only react to capital outflows during the same observation

periods, both in extreme and normal episodes. No significant reaction is demonstrated by the monetary authorities to capital inflow dynamics. Based on these findings, overall, this study confirms a potential to involve capital flow dynamics in the monetary policy setting, as an alternative policy rule in emerging and advanced economies.

Statement of Authorship

This declaration concerns the article entitled:			
What Drives Different Types of International Financial Flows? Disaggregation Analysis on Gross Capital Inflows			
Publication status (tick one) **Draft manuscript** [X] **Submitted** [ ] **In review** [ ] **Accepted** [ ] **Published** [ ]			
Publication details (reference)			
Copyright status (tick the appropriate statement) I hold the copyright for this material [ ] Copyright is retained by the publisher, but I have been given permission to replicate the material here [ ]			
Candidate's contribution to the paper (provide details, and also indicate as a percentage)	The candidate contributed to / considerably contributed to / predominantly executed the… Formulation of ideas: 100% Design of methodology: 100% ~~Experimental work:~~ Presentation of data in journal format: 100%		
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.		
Signed	Trinil Arimurti	**Date**	3 January 2020

Chapter 2. What Drives Different Types of International Financial Flows? Disaggregation Analysis on Gross Capital Inflows

2.1. Introduction

The 2007/08 global financial crisis revealed the interlinkages within the financial systems across countries, where we witnessed high capital mobility, not only during the crisis period, but also the periods afterwards. As integration in the global capital market continues, cross border investments have brought capital inflows to those more open economies. The European Central bank (ECB, 2016) highlighted the high capital flow volatility prior to and during the global financial crisis. The banking flows are one component of capital flows that has shown the most volatile pattern during these periods. In contrast, direct investment flows remained relatively steady at a high level. This finding supports the IMF Balance of Payment data based on capital inflows as presented in Figure 1-1. In addition, the dominance of 'other investment' flows, particularly in emerging economies, has been replaced by direct investment, since the Asian financial crisis in 1997-1998. Furthermore, significant changes are also evident in portfolio investment, specifically in advanced economies. Compared to other components, this type of inflows has risen steadily, accompanied by direct investment.

Despite the potential benefits offered by them, these large capital inflows at the same time also bring increased policy challenges. Particularly when the size and volatility of the inflows increases dramatically in a short period, and become large compared to the size of the domestic economy. Calvo et al. (1996) mentioned that "large capital inflows can also have less desirable macroeconomic effects, including rapid monetary expansion, inflationary pressures, real exchange rate appreciation and widening current account deficits". Furthermore, Sarno et al. (2016) mentioned that the surge in capital inflows might have consequences for domestic asset prices, particularly real estate price escalation, and high inflation, as well as effects on economic growth. On the other side, a sudden stop to the inflows is also risky for the domestic economy which may suffer from high interest rates, a sharp exchange rate depreciation and slower growth. In addition, the risks can also be exacerbated by gaps in domestic financial and institutional development. As a consequence, the financial system stability is harder to achieve. Moreover, the conduct of

monetary policy and liquidity management becomes more complicated. Therefore, it is essential for the recipient countries to put more emphasis on the sustainability of the capital inflows, as well as to monitor the impact of the flows on the domestic macroeconomy and the capital markets. Rey (2013) pointed out that capital flows may cause difficulties in macroeconomic management, and disturb monetary policy independence, although the countries have a flexible exchange rate policy. According to the IMF (2016), countries who are experiencing surges in capital inflows generally apply a policy mix to maintain domestic financial stability, which may cover macroeconomic policies, capital flow management measures and macroprudential measures. Thus, identifying the main determinants of capital inflows and understanding their behaviour is a critical step to assisting in the construction of an effective policy mix to safeguard the financial system's stability.

The literature generally classifies these determinants as pull and push factors. The pull factors refer to domestic indicators, while the push factors include global indicators associated with capital inflows. The country specific determinants may include economic growth, capital account openness, the depth of domestic financial markets, interest rates, exchange rates, political risk or institutional quality, and other macroeconomic or financial indicators (Reinhart and Reinhart (2009), Egly et al. (2010), Forbes & Warnock (2012), Sarno et al. (2016), and Byrne & Fiess (2016)). As for global determinants, even though the literature observes various indicators, there is an agreement that among others, global liquidity, global risk aversion, international interest rates, and global economic growth are the major drivers (Forbes & Warnock (2012), Rey (2013), Nier et al. (2014), Cerutti et al. (2015), Arias et al. (2016), and Baek & Song (2016)).

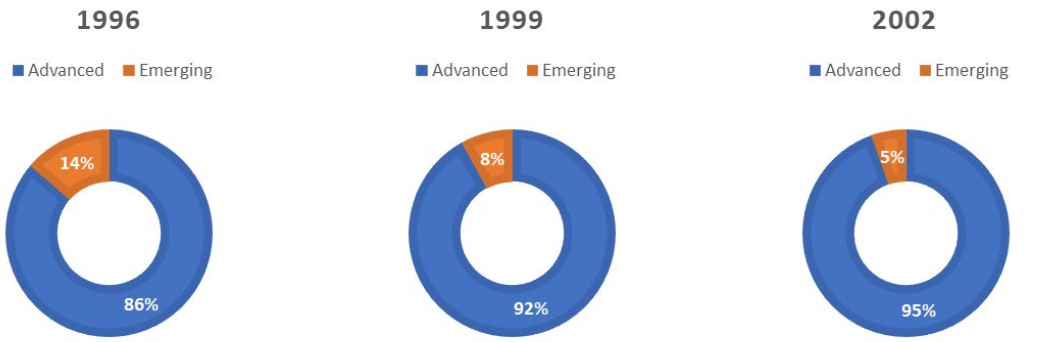
Distinguishing between the pull and push factors is a useful consideration for policy construction. Jevcak et al. (2010) suggested different policy implications for different sources of capital flows. When they are dominated by the push factors, the authorities should anticipate domestic vulnerability to global shocks. In contrast, when the pull factors play a greater role, domestic policies should be prioritized. In addition, the ECB (2016) stated that it is necessary to identify the root cause of cross border capital movements in order to design the optimum policies. Enhancing macroeconomic policies and macroprudential measures are an appropriate step to dealing with the pull drivers. On the other hand, if push factors act as the main drivers, the authorities may adjust their financial account management. Furthermore, a combination of policies between macroprudential

and other policies might be considered to deal with the possibility of the transmission of an unfavourable shock between countries.

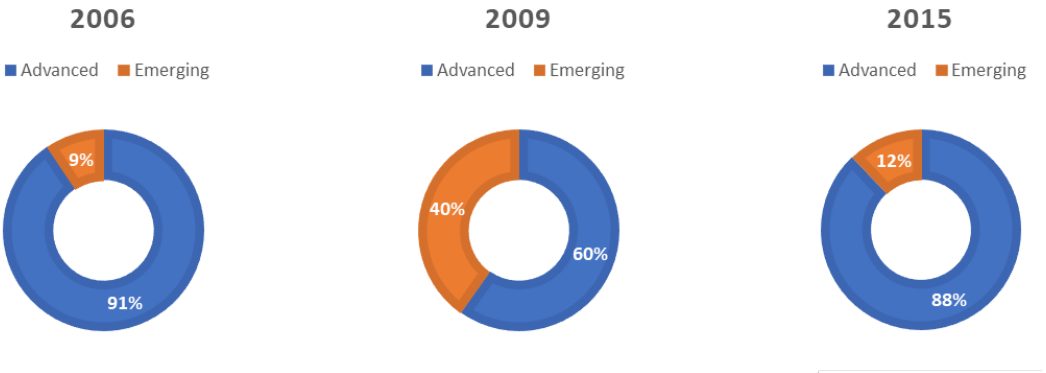
As discussed in the literature (IMF, 2016b), there have been changes in the structure and proportion of capital inflows to emerging and advanced economies. Focusing on the post global financial crisis (GFC) periods, it reported that during the recovery phase, the flows to advanced economies have increased, while the flows to emerging economies have declined. Furthermore, among different types of capital flows, other inflows, which covers the banking flows and derivative transactions have experienced the largest fall.

Figure 2-1. Shares of Gross Capital Inflows to Emerging and Advanced Economies (%)

Around Asian financial crisis time frame



Around the global financial crisis time frame



Source: IMF's Balance of Payments and author's calculations based on the data of 177 countries (141 emerging and 36 advanced countries)

Figure 2-1 depicts a shifting of capital inflows between both groups of economies during the two crisis time frames. Based on the shares of the total inflows, during the financial crisis that hit the Asian countries in 1997-1998, we witnessed more financial flows into advanced countries. In contrast, the global financial crisis of 2007-2008 was associated

with a higher share of capital flows directed to emerging economies. As discussed in ECB (2016), after Lehman Brothers downfall, many countries from the advanced economies decided to relax their monetary policy and executed quantitative easing programmes. However, along with an initial economic recovery in those countries, the most recent data has shown that capital inflows into emerging economies is now decreasing once more. Therefore, considering the disparity in both economies, in addition to the full sample, this study will also cover the analysis of key drivers of capital inflows into emerging and advanced economies.

2.1.1. Objectives and Contribution

Understanding the behaviour of the financial flows could help the authorities to construct an appropriate policy mix in order to safeguard the stability of the domestic financial system. In line with this concern of the policymakers, there has been a growing literature that empirically assesses the sensitivity of the flows to domestic and global factors. This study aims to identify the key drivers of aggregate and disaggregate capital inflows in emerging and advanced economies. At the disaggregate level, the potential heterogeneity between diverse types of inflows are considered in the estimation. Three major components of capital flows are included: direct investment (DI), portfolio investment (PI) and other investment (OI), which comprises elements such as the banking flows, derivative transactions and trade credits. Moreover, following the literature, the drivers are categorized into two groups, the domestic (pull) and global (push) factors.

The main contribution of this chapter lies in the methodology that is different from those used in the literature in this area. This study utilizes the bootstrapped fixed effects (FE) with seemingly unrelated regression (SUR) method, which is designed to estimate the models by taking account of the residual correlations. The expected correlations originate from the natural relationship between the different components (types) of capital inflows. In addition, our analysis covers an extensive panel dataset from 92 emerging and advanced economies during the period of 1990-2015.

To meet the research objective, this study relies on the gross capital inflows approach, as it allows us to observe the behaviour of foreign investors which are usually dissimilar to local investors. These objectives can be detailed further into several research questions like (i) what are the key drivers of aggregate and disaggregate capital inflows? (ii) how are the main drivers in emerging economies different from advanced economies? (iii) are there any consistent drivers in all types of inflows in all the samples? (iv) does the global financial

crisis play a role as an important driver? (v) should the policymakers focus more on domestic or global factors?

2.1.2. Outline of the Chapter

The reminder of this chapter is arranged as follows. Following the introduction, the next section briefly describes the previous studies focusing on capital inflow determinants. Section 3 reviews the data and its measurement, followed by section 4 that discusses the methodology. The bootstrapped fixed effect with seemingly unrelated regression is explained as my main methodology used to estimate the potential important drivers of disaggregate capital inflows, besides the fixed or random effects estimator used to regress the aggregate capital inflows (depending on the Hausman test result). Next, Section 5 presents the empirical results for all types of inflows in all of the sample sets (full sample, emerging and advanced economies). Finally, the conclusions regarding the main findings are presented in Section 6.

2.2. Literature Review

The concept of globalization is closely related to financial integration, which has led to borderless capital flows between countries over the last few decades. The global financial crisis has been one of the critical points that has raised economist's awareness of these capital movements. Substantial capital flow movements have often been associated with its volatility, which if not managed well, could lead to macroeconomic instability. Therefore, managing the benefits, as well as the risks originating from capital flows are essential for the authorities. Regardless of the country's level of development, the investigation on the major drivers of capital flows is a necessary initial step.

2.2.1. Capital Flows Measurement: Net vs Gross Approach

Different approaches have been utilized to capture the key drivers of capital flows. In terms of exploring the capital flow determinants, the literature has been focusing on two common approaches, gross and net capital flows. The net flows are defined as the difference between gross inflows and outflows. The most relevant approach is typically based on the specific objectives that need to be answered in a study. Ahmed & Zlate (2014) provided examples of when to use net and gross flows. They suggested that the net flows are more appropriate to analyse exchange rate appreciation and general overheating problems, while gross flows are suitable, for example, to find out how capital controls impact on foreign investment or financial stability conditions during quantitative easing policies that could affect global

liquidity. In line with that study, Gregorio (2013) also observed that the choice between the two approaches can be based on the risks and potential impacts. The gross approach is more appropriate to use when the aim of the study is to analyse how capital inflows impact upon the vulnerability of the financial system. On the other hand, the net inflows approach is most relevant when the analysis is related to exchange rates and competitiveness. Therefore, the choice between net and gross flows depends on the objective of the study.

Despite the continuing discussion on the net and gross flows approach, more recent studies are focusing on gross capital flows instead of net flows, for example Forbes & Warnock (2012), Byrne & Fiess (2016), Baek & Song (2016), Alberola et al. (2016), and Nier et al. (2014). The gross flows approach is beneficial because it cannot be separated from the argument that gross flows can capture the difference in foreign and domestic investors behaviour. Forbes & Warnock (2012) apply both approaches and found that the results are different when estimating the flows with disaggregation based on the investor type. They distinguished the capital movements that originated from foreign investors for gross capital inflows and by domestic investors for gross capital outflows. They argue that the difference in the results is because the net flows approach may potentially omit the crucial dynamic information contained in the capital movements because foreign and domestic investors can act in a manner which contradict each other or magnifies the stability of net capital flows. This is because both can respond differently to shocks or policy actions. Another example by Arias et al. (2016) who used gross capital inflows data to analyse the long-term relationship between capital flows and their determinants. In addition, the recent study by Alberola et al. (2016) also emphasizes gross flow data to analyse the behaviour of gross capital flows which are related to international reserves.

As one of the consequences of the global financial crisis, the central banks in advanced economies like the United States, United Kingdom, Europe including Scandinavia have stimulated the domestic economy by implementing unconventional monetary policies. Excess global liquidity could not be avoided, thus, emerging economies have placed more attention on the spill-over effects and effects on domestic financial stability, since they may induce significant turmoil into the financial markets. To capture this effect on capital markets, analyses of gross capital flows, particularly on the inflows side becomes very relevant. Baek & Song (2016) for example found that factors including global, contagion, and domestic have significantly affected the gross loan inflows, (the loan-led episodes initiated by foreigners), both in surge and stop episodes. Moreover, compared to advanced economies, the domestic factors are more related with the stop than surge episodes in

emerging economies. In addition, using the gross inflows approach, Byrne & Fiess (2016) suggested that global capital flows showed strong links with the long-run bond yields and commodity prices. Furthermore, the country flows are significantly influenced by financial openness and institutions. Other research also focuses on both gross inflows and outflows such as Arias et al. (2016) who study both inflows and outflows to see the different factors that matter to both types of capital. In addition, Forbes & Warnock (2012) suggest that without disaggregating the gross capital flows based on inflows and outflows, the overall dynamics and reasons for capital flow waves would not be captured. By distinguishing between both types of capital flows they found that in many episodes that were previously identified as sharp increases in gross capital inflows (surges), they were in fact caused by sharp decreases in gross capital outflows (retrenchment). Alberola et al. (2016) particularly studied the influence of international reserve accumulation on capital flow behaviour by differentiating between the behaviour of foreign investors into the domestic economy from investors abroad. They found that during periods of global stress, the level of international reserves affects gross domestic outflows, but conclusions for gross foreign inflows are less clear.

One of several studies that use the net flows approach is Sarno et al. (2016) who examined the behaviour of international portfolio flows focusing on differences between bond and equity flows. Another study on net flows was by Ahmed & Zlate (2014) who are assessed the behavioural changes in net inflows during the period before and after the global financial crisis and the effect of capital controls on net portfolio inflows.

2.2.2. Determinants of Capital Flows

Discussions on the determinants of capital flows have historically been defined broadly and become more specific during the period of global financial stress. Typically, the literature presents two types of major drivers, the global factors which are also known as push factors and domestic factors that are commonly referred to as pull factors (see, e.g., Calvo et al. (1996), Fernandez-Arias (1996), Taylor & Sarno (1997), Agenor (1998), Forbes & Warnock (2012), Fratzscher (2012), Sarno et al. (2016), ECB (2016), and Byrne & Fiess (2016)). The classification of these factors cannot be separated from the underlying idea of the portfolio balance approach, where the expected returns, risk, and risk preferences across countries are important for determining capital flows (Ahmed and Zlate (2014), Ahmed Hannan (2017)).

The literature on capital flow determinants has suggested that the push factors are closely related to the concept of neoclassical theory, which predicts that capital reacts to interest rate differentials between countries. Under this concept, capital flows from the low return countries to those that can offer high returns (Hannan, 2018). Other variables from the push factors which may drive capital inflows into investment in other countries have been discussed in recent studies for instance, global economic growth, risk aversion, commodity prices and global liquidity (see, e.g., Reinhart and Reinhart (2009), Egly et al. (2010), Forbes & Warnock (2012), Bruno & Shin (2014), Arias et al. (2016), Sarno et al. (2016), Byrne & Fiess (2016), and Baek & Song (2016)).

On the other hand, pull factors refer to component variables originating from domestic factors that influence the risks and returns to investors, and depend on local macroeconomic fundamentals, official policies and market imperfections (Ghosh et al., 2012). These factors can be domestic interest rates, economic growth, inflation, trade openness, quality of domestic institutions, the current account balance, real exchange rate, public debt or other relevant variables (Papaioannou (2008), Milesi-Ferretti and Tilee (2011), Fratzscher (2011), Nier et al. (2014), Bruno & Shin (2014), Olaberria (2014), Dell'Erba & Reinhardt (2015), Hashimoto & Wacker (2016), Iamsiraroj (2016), Baek & Song (2016), and Arias et al. (2016)).

Recent empirical research discloses that global (push) factors effects on capital flows are typically more dominant than domestic (pull) factors (see, e.g., Calvo et al. (1996), Fernandez-Arias (1996), Jevcak et al. (2010), Forbes & Warnock (2012), Byrne & Fiess (2016), and Sarno et al. (2016)). Calvo et al. (1996) for example, stated that interest rate movements are the most notable reason for the surges in capital inflows. Fernandez-Arias (1996) also focuses on the impact of international interest rates in attracting capital inflows into developing countries. These flows have particularly been determined by the low investment returns in developed countries, either directly or indirectly, via the creditworthiness channel. The high dependency of developing countries on the external factors has brought consequences to the stability of the domestic economy, particularly if there are adjustments on the investment returns applied in developed countries. Moreover, Jevcak et al. (2010) in their sample of the new EU Member States from Central and Eastern Europe (NMS10) also found that the external drivers are essential for capital inflows to these area, predominantly the Euro area interest rates, risk sentiment and the business cycle. Additionally, Forbes & Warnock (2012) explored the major factors of capital flow waves

by focusing on global factors. They found that global risk, with contagion factors[2], are the most important drivers of the extreme capital flow episodes, which are characterized by surges and slumps in the inflows and flight and retrenchment for the outflows[3]. Although domestic factors are also involved, the impacts are generally small. Another study by Byrne & Fiess (2016) underlined the importance of global factors for international capital movements into emerging markets. They investigated the aggregate and disaggregate components of capital inflows and concluded that push factors such as the real US long-run interest rates and commodity prices have a significant impact on capital inflows, along with financial openness and institutions from among the pull factors. Additionally, Sarno et al. (2016) suggested that both push and pull factors have contributed to international portfolio flow movements between the US and other countries. However, a stronger affect originates from the push factors compared to pull factors, indicates that the authorities need to consider the global economic conditions when applying domestic policies. Thus, their study recommends capital controls compared to the use of macroprudential policies.

From another perspective, some recent studies, Arias et al. (2016) for instance, examined the long-term determinants of gross capital flows into developing economies. The research proved the existence of a co-integrating relationship between gross capital inflows and both pull and push factors. Indicators such as GDP growth, public debt, and interest rate differentials matter for FDI inflows, while portfolio investment is affected by international financial market volatility and foreign asset prices. The negative long-term connection between FDI with the interest rate differentials, however, was discussed as a puzzling finding. Moreover, another challenge found the lack of a long-term relationship between the portfolio investment with the interest rate differentials, as expected from the standard portfolio assumption.

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[2] The contagion factors in Forbes & Warnock (2012) are measured by three indicators: financial linkages (which involves a financial openness measure), trade linkages (export-weighted average of rest-of-the-world episodes) and regional proximity (where a dummy variable is set equal to one if a country in the same region has an episode).

[3] Forbes & Warnock (2012) defines the episodes of sharp increase and decrease in capital inflows as “surges” and “stops” respectively, while sharp increase and decrease in capital outflows are correspondingly distinguished as “flight” and “retrenchment” episodes.

Table 2-1. The Literature Findings on the Main Drivers of Capital Inflows

No	Important Drivers	Sign	Authors
Domestic Factors			
1	Credit	(+)	Baek & Song (2016), Broto et al. (2011)
2	Trade openness	(+)	Hashimoto & Wacker (2016), Iamsiraroj (2016), Mcquade & Schmitz (2016), Milesi-Ferretti and Tilee (2011).
3	Domestic GDP growth	(+)	Arias et al. (2016), Baek & Song (2016), Hashimoto & Wacker (2016), Mcquade & Schmitz (2016), Park et al. (2015), Bruno & Shin (2014), Olaberria (2014), Contessi et al. (2012), Forbes & Warnock (2012), Fratzscher (2012), Jevcak et al. (2010).
4	Financial openness	(+)	Sarno et al. (2016), Byrne & Fiess (2016), Hashimoto & Wacker (2016), Olaberria (2014).
5	Debt	(-)	Arias et al. (2016), Baek & Song (2016), Bruno & Shin (2014), Nier et al. (2014).
6	Financial development (market capitalization)	(+)	Nier et al. (2014)
7	Exchange rates	(+)	Dell'Erba & Reinhardt (2015), Nier et al. (2014)
8	Interest rates	(+)	Nier et al. (2014), Bruno & Shin (2014), Contessi et al. (2012).
9	Political risk/ institutional quality	(+)	Baek & Song (2016), Byrne & Fiess (2016), Hashimoto & Wacker (2016), Olaberria (2014), Fratzscher (2012), Alfaro et al. (2008).
Global Factors			
10	Global growth	(+)	Dell'Erba & Reinhardt (2015), Forbes & Warnock (2012), Milesi-Ferretti and Tilee (2011)
11	US government bond yield	(-)	Byrne & Fiess (2016), Cerutti et al. (2015), Park et al. (2015)
12	Global financial market volatility (VXO or VIX index)	(-)	Arias et al. (2016), Baek & Song (2016), Mcquade & Schmitz (2016), Cerutti et al. (2015), Park et al. (2015), Nier et al. (2014), Olaberria (2014), Forbes & Warnock (2012), Milesi-Ferretti and Tilee (2011).
13	Global liquidity	(+)	Baek & Song (2016), Bruno & Shin (2014).

In addition, Nier et al. (2014) analysed the non-linear effects of the global volatility index (VIX) [4] as an indicator of the global financial cycle on capital flows to emerging markets, found that during low levels of VIX, the fundamental factors such as growth rate differentials, government debt, and financial sector development stand out as the major drivers of capital flows. However, for high levels of VIX, VIX becomes the most significant factor, besides the interest rate differentials. Furthermore, they also suggest that financial market development and capital mobility magnify the VIX effects on capital flows. In addition, Bruno and Shin (2014) found that several pull factors such as the exchange rate, domestic money supply, GDP growth, inflation, public debt, and interest spread are important for capital inflows into emerging economies. Several important findings from the previous studies on the determinants of capital inflows are summarized in Table 2-1.

2.3. Data and Measurement

2.3.1. Data

This study uses 26 years of annual observations, starting from 1990 to 2015. The total number of countries included in the sample is 92, which consists of 65 emerging markets and developing economies and 27 advanced economies. The selection of the countries is based on the capital flow data availability. A list of the countries is presented in the appendices (Table A2-1), along with the level of market development, according to the IMF category.

The data are primarily gathered from the IMF, particularly from the Balance of Payments (BOP), International Financial Statistics (IFS) and World Economic Outlook (WEO). Other data sources include such as World Development Indicators (WDI), the Chicago Board Options Exchange (CBOE), and Political Risk Service (PRS), and Chin & Ito (2008). Table 2-2 lists the dependent and independent variables together with the data sources. The dependent variables consist of aggregate and disaggregate capital inflows.

[4] VIX is introduced by CBOE in 1993 as a measurement of short-term market expectation. VIX is expressed in S&P 500 stock index option prices and widely used as an indicator of investor confidence in the market or as a signal of investment risk. The index value interpretation is in line with the uncertainty level in the market, thus, a higher index value indicates higher uncertainty level due to market volatility.

Table 2-2. List of Variables and Data Sources

Variables	Unit	Sources
Dependent Variables		
Direct Investment	Percent of GDP	Balance of Payments (BOP), Author calculations
Portfolio Investment	Percent of GDP	Balance of Payments (BOP), Author calculations
Other Investment	Percent of GDP	Balance of Payments (BOP), Author calculations
Aggregate Investment	Percent of GDP	Balance of Payments (BOP), Author calculations
Independent Variables		
Domestic (Pull) Factors		
Credit to Private Sector	Percent (annual changes of credit to GDP ratio)	World Development Indicator (WDI), Author calculations
Trade Openness	Percent of GDP	World Development Indicator (WDI), Author calculations
Domestic GDP Growth	Percent	International Financial Statistics (IFS)
Financial Openness	Index	Chin & Ito (2008)
Gross Debt	Percent of GDP	World Economic Outlook (WEO)
Financial Development	Index	International Monetary Fund (IMF)
REER	Percent (annual changes of REER index)	Bruegel.org, Author calculations
Real Interest Rate	Percent	World Development Indicator (WDI)
Political Risk	Index of political risk, based on International Country Risk Guide (ICRG)	Political Risk Service (PRS)
Global (Push) Factors		
Global Growth	Percent	International Financial Statistics (IFS)
US Government Bond Yield	Percent	International Financial Statistics (IFS)
VXO	Index	Chicago Board Options Exchange (CBOE)
Money Growth	Percent (the average of broad money growth in Euro Area, US & Japan)	International Financial Statistics (IFS)

This study covers three types of capital flows, namely direct investment (DI), portfolio investment (PI), and other investment (OI)[5]. The summation of those components defines the aggregate investment (AI), which will be estimated along with the disaggregate flows.

[5] Other investment in this chapter refers to the IMF definitions as explained in the Balance of Payments and International Investment Position Manual (BPM6) in paragraph 6.61, which includes components such as currency and deposits, loans, other equity, and trade credits.

All capital flows data (in US dollars) are previously divided by the nominal GDP (in US dollars) to obtain the ratio of capital flows over GDP.

The first set of independent variables primarily measures the domestic drivers of capital flows which are also known as the pull factors. The external exposure is assessed by trade openness and financial openness, as a proxy of the degree of capital account openness. Other domestic drivers also include the financial development, which has been developed by the IMF to represent the level of development of financial institutions and financial markets, and the country risk, that is denoted by the political risk index. The rest of the domestic factor covers macroeconomic variables such as GDP growth, credit to the private sector, real effective exchange rate, and real interest rates and gross debt ratio relative to GDP.

The second set measures the global (push) factors, including the global economic growth, global interest rates, which are proxied by the US government bond yield, global liquidity as approximated by broad money growth, and the VXO index as a representation of volatility in the US (international) stock market. We expect that a country with strong domestic institutions and economic fundamentals will attract more capital inflows. In addition, these countries generally face less risk from capital flow reversals and gain protection from harmful external shocks.

To reduce the effect of the outliers, some variables are winsorized at the 1% level. Using this technique, the 1% largest and 1% smallest observations are replaced by the values of the 99^{th} and 1^{st} percentile respectively. Specifically, this method is applied to capital flow variables and most of the domestic variables, such as credit to the private sector, financial development, gross debt, real effective exchange rate, trade openness, real interest rate, and domestic GDP growth. In the literature related to capital flow measures, this technique has been performed by among others Bruno et al. (2014), who winsorized the data at the 2.5% level. Nevertheless, this study follows a typical approach to deal with the outliers by applying the 1% data winsorizing. The summary statistics of all indicators is provided in the appendices (Table A2-2). A distinction is made between two groups of determinants. The first group of variables primarily measures the pull factors that originated from domestic indicators. The second set relates to the push factors, which represent the global indicators.

2.3.2. Variables

Instead of working with net capital flows, this study is focusing on gross capital inflows. As explained in the previous section, this approach allows us to capture the behaviour of foreign investors and their response to the shocks. Four measures of the dependent variables of capital inflows (aggregated and disaggregated) are estimated in each set of samples. In addition, selected independent variables, covering both push and pull factors are chosen based on the discussion in the related literature. One of the reasons for their inclusion is related to the traditional neoclassical theory, which suggested that under the assumption of free capital mobility, there will be capitals flows from the more developed countries to less developed countries with limited resources. However, in practice, it is not always the case, as only limited capital flows in this direction. The Lucas paradox explained two main reasons for this dynamic, the fundamental factors, and capital market imperfections and asymmetric information. It proves that the rate of return is not the only consideration for the investor to invest more in a particular country. Alfaro et al. (2008) and Reinhardt et al. (2013) among others have empirically studied the reasons that can explain this paradox. Factors like financial openness and institutional quality for example, are found to be relevant for this case. This aspect will be discussed further in the model specification section.

Following the literature, the push factors in this study refer to the global indicators, while the pull factors represent the domestic indicators. The domestic factors can also be classified into external exposures (trade openness and financial openness), macroeconomic fundamentals (domestic credit to private sector, financial development, GDP growth, the real effective exchange rate, gross debt, and real interest rate), and the political risk index. Furthermore, the global factors include global economic growth, the US government bond yield, broad money growth, and the VXO index.

The Balance of Payments and International Investment Position Manual (BPM6) (IMF, 2009) classifies the international accounts into 5 functional categories of investment: direct investment, portfolio investment, other investment, financial derivatives (other than reserves) and employee stock options, and reserve assets. In line with the existing research, we will be focusing on three major types of investments: the direct investment, portfolio investment, and other investments.

a. Direct Investment

Based on the BPM6 published by the IMF, paragraph 6.8 specifically defines direct investment as follows:

> "A category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy".

In addition, Contessi et al. (2012) provides examples of direct investment based on the IMF (2007), which includes equity capital, reinvested earnings, other capital, and financial derivatives associated with various inter-company transactions between affiliated companies.

b. Portfolio Investment

The definition of portfolio investment is explained by the IMF in BPM6, paragraph 6.54 which states that:

> "Portfolio investment is cross border transactions and positions involving debt or equity securities, other than those included in direct investment or reserve assets. Portfolio investment covers, but is not limited to, securities traded on organized or other financial markets".

Furthermore, based on the IFS, Contessi et al. (2012) also explained that portfolio investment comprises financial securities of any maturity, including corporate securities, bonds, notes, money market instruments, and other than those included in direct investment or reserve assets. This includes bonds, debentures, notes, and money market or negotiable debt instruments. Unlike in the direct investment where there is an expectation of establishing a long-term relationship, as well as getting a significant degree of influence in the management of the enterprise, the intention of investing in portfolios is mostly focusing on the earnings from investment activities, such as from purchasing and selling the shares or other securities. In other words, obtaining a significant return is the main goal of the investors who invest in portfolio investment.

c. Other Investment

Lastly, in paragraph 6.61 of the BPM6, IMF describes other investment as:

> "Other investment is a residual category that includes positions and transactions other than those included in direct investment, portfolio investment, financial derivatives and employee stock options, and reserve assets".

In addition, the IMF also categorizes several types of investment which are included in other investment: (i) other equity, (ii) currency and deposits, (iii) loans (including use of IMF credit and loans from the IMF), (iv) nonlife insurance technical reserves, life insurance and annuities entitlements, pension entitlements, and provisions for calls under standardized guarantees, (v) trade credit and advances, (vi) other accounts receivable/payable, and (vii) SDR allocations (SDR holdings are included in reserve assets).

In addition to capital flows variables, below are several determinants used as independent variables in the estimation:

- Credit to private sectors

  Referring to the IMF, domestic credit to the private sector is defined as the financial resources offered by financial entities to the private sectors. These resources can be provided in several forms like loans, purchases of nonequity securities, and trade credits and other accounts receivable. This study includes the growth of the ratio of credit to GDP in the estimation. As explained by Broto et al. (2011), this indicator can reflect the level of development of the domestic banking system. However, it can also represent a signal episode of economic overheating, which indicates a rise in economic volatility.

- Financial Development

  This indicator has been developed by the IMF (Sahay et al., 2015) and considers an enhanced measurement using multiple indicators of the development of the financial system across economies. As described by Svirydzenka (2016), the financial development index quantifies the level of development of financial institutions and financial markets based on the following definition:

  > "Financial development is defined as a combination of depth (size and liquidity of markets), access (ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues, and the level of activity of capital markets)" (Svirydzenka, 2016, p.5).

  Compared to other measures like the ratio of private credit to GDP or stock market capitalization to GDP that have generally been used as a typical representation of financial market development in empirical literatures, this indicator considers a more complex multi-dimensional measurement of financial development. A previous study by Nier et al. (2014) for example, emphasised the important role of financial

development for capital inflows and their development, particularly in emerging economies.

- Trade openness

  This study utilizes trade openness as a measure of the degree of openness in terms of international trade. According to the World Development Indicators (WDI), it is measured as the sum of exports and imports of goods and services in the share of gross domestic product. A higher ratio indicates a higher level of integration in the global markets. Trade openness has been discussed in some literature as one of the main determinants of capital flows. Among others are Hashimoto & Wacker (2016), Iamsiraroj (2016), and Mcquade & Schmitz (2016).

- Real interest rates

  Real interest rate data in this thesis is in terms of the definition in WDI. It is defined as "the lending interest rates adjusted for inflation as measured by the GDP deflator". In other words, this statement can be written as:

  $$r = i - \pi$$

  where r is real interest rate; i is nominal lending interest rate, and π is the percentage change in the GDP deflator.

  Since $\pi = \%\Delta GDP\ deflator = \%\Delta \frac{Nominal\ GDP}{Real\ GDP} x100$, we can rewrite the equation as:

  $$r = i - \left[\%\Delta \frac{Nominal\ GDP}{Real\ GDP} x100\right]$$

  Generally, foreign investors would normally seek higher investment returns, which leads to financial flows to those countries with more favourable interest rates. Contessi et al. (2012) is part of the literature that analyses the linkage of this variable with gross financial inflows, particularly in emerging market countries.

- Financial Openness

  The financial openness data is adopted from Chin and Ito (2008). This index represents the degree of openness in the capital account in a country. As stated by the authors, the calculation of this index is based on restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. An increase in the index indicates lower restraints on the capital account, thus, specifying a more open country. This indicator has been used by a growing part of

the literature as one of the most important indicators for capital inflows, e.g. Byrne & Fiess (2016), Sarno et al., (2016), Hashimoto & Wacker (2016), and Olaberria (2014).

- Gross debt

  This variable is included as a proxy of sovereign risk. Gross debt in this study refers to general government gross debt from the World Economic Outlook (WEO) which is expressed as the percentage of GDP. According to the WEO, "Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable". Nier et al. (2014) suggested that government debt is an essential determinant of credit ratings, which can reflect the sovereign risk, thus, might affect capital flows. In addition, Milesi-Ferretti and Tilee (2011) mentioned that foreign investors generally consider the country's indebtedness before allocating their investment. Countries with disproportionately large debt levels are perceived as riskier investment destinations, besides diminishing the domestic bond's attractiveness to foreign investors. Thus, countries tend to receive higher capital inflows when the government debt is at a safe level. The relationship of this variable to capital inflows has been explored previously among others by Bruno & Shin (2014), Arias et al. (2016), and Baek & Song (2016).

- The Real Effective Exchange Rate (REER)

  The IMF defines REER as the nominal effective exchange rate divided by a price deflator or index of costs. REER measures the value of a country's currency against other countries' currencies in a weighted average. A higher REER infers a lower degree of trade competitiveness, because the price of goods exported becomes higher while the price of goods imported becomes lower. As discussed in Calvo et al. (1993), an increase in the REER index represents a domestic currency appreciation. Following Dell'Erba & Reinhardt (2015), this indicator also represents a competitiveness. Their study suggested that an appreciation is connected with a sharp increase in FDI. In line with that argument, Nier (2014) also suggested that a higher REER is related to higher gross financial inflows.

- GDP growth

  Gross Domestic Product growth is defined by the IMF International Financial Statistics as the percentage change of GDP volume. There is an extensive literature that has explored domestic GDP growth as an important determinant for capital inflows.

Fratzscher (2012) investigated the role of this variable for capital inflows in the periods before, during and after the global financial crisis. In addition, Jevcak et al. (2010) also confirmed the connection of domestic growth with foreign capital inflows in the NMS10 (new EU Member States from Central and Eastern Europe).

- Political Risk

  In this study, the political risk index is a proxy of domestic country risk which is related to political stability. This index is calculated by the Political Risk Service (PRS) group. There are 12 components with different weights used to measure the political and social indicators. The component with the highest points are (i) government stability; (ii) socioeconomic conditions; (iii) investment profile; (iv) internal conflict, and (v) external conflict. The next components with a lower point are (vi) corruption; (vii) military in politics; (viii) religious tensions; (ix) law and order; (x) ethnic tensions; and (xi) democratic accountability and (xii) bureaucracy quality. A higher value refers to lower political risk, and vice versa. The association of this index with capital flows has been studied previously, such as Alfaro et al. (2008), Fratzscher (2012), Olaberria (2014), Hashimoto & Wacker (2016), and Byrne & Fiess (2016).

- Global GDP growth

  The Global GDP growth used in this study is world GDP growth based on GDP volume measures compiled by the IMF. Global growth has been widely used in the literatures as an important push factor on capital inflows, among others by Milesi-Ferretti and Tilee (2011), Forbes & Warnock (2012), and Dell'Erba & Reinhardt (2015).

- US Government bond yield

  The US government bond yield is often associated with the long-term global interest rates, as well as a proxy for the foreign yields. It is one type of low risk investment, since it is backed up by the US government, thus, making it an attractive instrument for investors. US government bond yields have been widely analysed as one of the push factors of capital inflows, particularly to emerging economies. Among others, this approach has been used by Byrne & Fiess (2016), who suggest that higher capital inflows to emerging markets are associated with a decline in the long-run bond yields in the US. In line with that, other studies have also used this approach such as Cerutti et al. (2015) and Park et al. (2015).

- VXO Index

  The variable VXO represents the annual average of the VXO index calculated by the Chicago Board Options Exchange (CBOE) based on the trading of S&P 100 (OEX)

options. This index has been considered as an indicator of the perceived risk of investors as well as short term market expectations of volatility or uncertainty in the stock market. A higher VXO index suggests a higher implied volatility in the stock market. Some recent literature has emphasised the role of this variable for capital inflows, such as Olaberria (2014) who suggested that gross capital inflows to emerging markets are strongly related to global risk aversion. In addition, Nier et al. (2014) observe that stock market volatility is one of the substantial push factors associated with gross capital inflows into emerging countries. Given the nature of this indicator, in the short term, a low level of volatility in the stock market is a preferable sign to the investor to expand their investment abroad.

- Broad Money Growth

  The broad money growth indicator in this study is used as a representation of the global liquidity. The International Financial Statistics (IFS line 35L..ZK...) defines broad money as:

  > "…the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveller's checks; and other securities such as certificates of deposit and commercial paper".

  Following some existing literature, this variable is calculated by taking the average of broad money growth in three major economies, namely Japan, United States, and Euro Area. Baek & Song (2016) for example, have explored the relationship between global liquidity with capital inflows. Their research particularly explored whether an increase in global liquidity is connected with more surges (sharp increases in capital inflows) and less stop (sharp decreases in capital inflows) episodes.

- Dummy variable for the global financial crisis (GFC)

  This variable represents the global financial crisis with the value of 1 for the crisis period (2007-2008) and 0 otherwise.

2.4. Methodology

In line with the objective in this chapter, I apply a different approach to identify the key drivers of capital inflows at the aggregate and disaggregate level. This is due to the expected correlation of the error terms between the equations, given the nature of each type of the financial flows (direct investment, portfolio investment and other investment). Furthermore, according to Baltagi (2005), the cross-sectional dependence is a typical concern in macro panels with long time series. Therefore, whilst the aggregate flow is estimated using ordinary least squares (OLS) and the fixed effects (FE) or random effects (RE) estimator, the disaggregate flows will be estimated by applying the Fixed effects with Seemingly Unrelated Regression (FE with SUR). Since the aggregate flows comprises all three components of the flows, the aggregate investment equation excludes these equation systems and is estimated using different estimators, between the fixed effects or random effects estimator, subject to the Hausman test recommendation. In order to obtain more robust standard errors, the bootstrap approach is applied, following Cameron and Trivedi (2005). Hence, in the next section, we refer to this method as the bootstrap FE with SUR. Before the SUR estimation, the Breusch and Pagan test for error independence is applied. The null hypothesis is that residuals across equations are not correlated, thus a rejection of the null hypothesis indicates the existence of correlation. If this is the case, using the SUR estimator will give more efficient results.

2.4.1. Fixed effects Models

Fixed effects models are generally designed to study the relationship between variables over time. The estimation is emphasizing the impact of the variables within the individual or countries in terms of unobserved heterogeneity within the sample. In other words, this model controls for the time-invariant differences between the countries, thus, providing unbiased parameter estimates in the face of the unobservable heterogeneity. The individual effects may refer to countries, entities, firms, cities, or other cross sectional units (Wooldridge, 2010). Furthermore, as explained by Park (2011), the individual differences are accommodated by the fixed effects models. In the general form of the fixed effects model as shown in equation (2.1), u_i which is part of the intercept, is allowed to be correlated with the regressors. This is because the individual specific effect is time invariant and reflected in the intercept. Thus, to determine the best estimator, we need to see whether the correlation between the u_i and explanatory variables exists.

$$Y_{it} = (\alpha + u_i) + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + \varepsilon_{it} \quad (2.1)$$

where:

Y_{it} : dependent variable

α : intercept

β_k : parameter estimates of the k[th] explanatory variable

$X_{k,it}$: the k[th] explanatory variable

ε_{it} : error term

u_i : fixed or random effects specific to individual or time period

u_i refers to the unobserved heterogeneity. It is also called an unobserved effect, as it is randomly drawn from the population together with Y_{it} and X_{it}. The impact of time-invariant characteristics in the fixed effects model is eliminated, so that the net impact can be estimated. Thus, controlling the unobserved heterogeneity allows us to estimate the genuine influences of the explanatory variables on the dependent variable.

Despite the advantage of the fixed effects model, it also has a drawback. The potential individual properties that affect the explanatory variables need to be determined. The main alternative to fixed effects is random effects, this is estimated by generalised least squares taking into account that the error terms within countries may be correlated.

2.4.2. Random effects Model

In contrast to the fixed effects model, the random effects model assumes that the variation across the individuals (α) is random and uncorrelated with the explanatory variables (X_{it}). This model is used when we have some knowledge about variation across individuals which is significantly affecting the Y_{it}. One advantage of this model over the fixed effects model lies in the possibility of including time-invariant variables. As we noticed, in the fixed effects model, it is incorporated into the intercept. Park (2011) emphasizes that the main difference between the fixed and random effects model is the use of dummy variables. In the fixed effects model, the parameter estimates of the dummy variables are integrated into the intercept (equation (2.1)), while in the random effects model, are part of the error component (equation (2.2)). The summary of similarities and differences between the two approaches as presented in Table 2-3.

A random effect model commonly puts the u_i into the error term and follows the form below:

$$Y_{it} = \alpha + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + (u_i + \varepsilon_{it}) \quad (2.2)$$

Now we have the composite error $\delta_{it} = u_{it} + \varepsilon_{it}$, and rewrite the model as follows:

$$Y_{it} = \alpha + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + \delta_{it} \quad (2.3)$$

Table 2-3. Fixed and Random Effects Model Comparison

	Fixed effects Model	Random effects Model
Assumption	-	Individual effects are not correlated with regressors
Intercepts	Varying across group	Constant
Error variances	Constant	Randomly distributed across group and/or time
Slopes	Constant	Constant
Estimation	LSDV, within estimation	GLS, FGLS (EGLS)
Hypothesis test	F test	Breusch-Pagan LM test

As correlation between the error term and independent variables is not allowed, this model needs to satisfy the strict exogeneity assumption below:

$E(\delta_{it} | X_{it}) = 0$ where t=0,1,2,….,T.

2.4.3. Hausman Test

The Hausman test is the method proposed by Hausman (1978) to test for the exogeneity assumption of the unobserved error. Thus, it enables us to test for significant differences between the random effects and fixed effects estimates (Cameron and Trivedi, 2005). The null hypothesis states that individual specific effects are uncorrelated with the regressors. Therefore, a rejection of the null hypothesis indicates that fixed effects is more efficient and a preferable model compared to the random effects model, because the individual effects μ_i are potentially correlated with the regressors. In this case, the random effects model would be inconsistent.

2.4.4. Seemingly Unrelated Regression (SUR)

Proposed by Zellner (1962), the Seemingly Unrelated Regressions (SUR) is an estimation method designed to estimate a system of linear equations that allows the error terms across equations to be correlated.

Consider the following set of equations:

$Y_i = \beta_i X_i + \varepsilon_i$ for i = 1,…, m, where index i is the i-th equation in the equations system.

This general equation can also be specified in the matrices form below:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & X_m \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_m \end{bmatrix} \tag{2.4}$$

If K_i parameters are estimated in i-th equation, the total number of coefficients is $K = \sum_{i=1}^{m} K_i$, where $K_i > T_i$. Here the assumption of strict exogeneity is applied, so $E(\varepsilon | X_1, \dots, X_m) = 0$.

Under SUR approach, the covariance matrix of the error term below can be assumed to be not diagonal:

$$\Omega = E(\varepsilon\varepsilon|' X_1, \dots, X_m) = \begin{bmatrix} \sigma_{11}^2 I & \sigma_{12}^2 I & \dots & \sigma_{1m}^2 I \\ \sigma_{21}^2 I & \sigma_{22}^2 I & \dots & \sigma_{2m}^2 I \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{m1}^2 I & \sigma_{m2}^2 I & \dots & \sigma_{mm}^2 I \end{bmatrix} \tag{2.5}$$

The literature suggests applying the feasible generalized least squares (FGLS) method to estimate the error terms variance-covariance matrix above. The estimation process is executed in two steps: involving an OLS regression in the first step, and GLS regression in the second step. The unbiased estimates of the error terms variance-covariance matrix (Ω) obtained from the OLS is adopted for the next step using the GLS estimator.

$$\hat{\beta}^{SUR} = \left(X' \hat{\Omega}^{-1} X\right)^{-1} X' \hat{\Omega}^{-1} y \tag{2.6}$$

When the Ω is diagonal, the value of $\hat{\beta}^{SUR}$ will be close to the estimation result from the OLS estimator.

For panel data estimation, a system of equations from a standard linear model can be expressed as:

$$\begin{aligned} y_1 &= \beta_1' X_1 + \varepsilon_1 \\ y_2 &= \beta_2' X_2 + \varepsilon_2 \\ \vdots &= \vdots \\ y_N &= \beta_N' X_N + \varepsilon_N \end{aligned} \tag{2.7}$$

where β_N is the individual specific vector of the structural parameter.

Although each equation involves estimating different dependent variables and seems to be separated from the other equations, with some similar set of explanatory variables, it is possible that the error terms across equations are correlated. When the correlation exists, the OLS estimator would still deliver unbiased outcomes, nevertheless, they are not efficient. In this case, the SUR framework can offer more efficient estimates, as it accounts for cross equation dependence. Moreover, Zellner (1962) suggested that the SUR estimation produces no further advantage from estimating the system jointly under two conditions: (i) when the errors are uncorrelated across equations, and (ii) when each equation has an identical set of regressors. In this case, the results from SUR estimation will be the same with the ones from OLS. Given the nature of the capital flows, it is common to expect a cross correlation of the error terms between the equation of each type of flows, suggesting that the OLS estimator is no longer efficient. Therefore, this SUR approach will be applied for estimating disaggregate capital flows in this study. Whilst the aggregate flows will be estimated using the OLS estimator, in addition to the FE and RE estimator.

One method for testing the correlation between the error term across equations is the Breusch & Pagan (1980) test for error independence. Below is the suggested LM statistic for this approach:

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{i,j}^2 \tag{2.8}$$

where $\rho_{i,j}$ is the coefficient of cross-sectional correlation as in the equation below:

$$\hat{\rho}_{i,j} = \frac{\sum_{t=1}^{T} \hat{\varepsilon}_{i,t}\, \hat{\varepsilon}_{j,t}}{\left(\sum_{t=1}^{T} \hat{\varepsilon}_{i,t}\right)^{\frac{1}{2}} \left(\sum_{t=1}^{T} \hat{\varepsilon}_{j,t}\right)^{\frac{1}{2}}} \tag{2.9}$$

The LM statistic is asymptomatically distributed as χ^2 with N(N-1)/2 degrees of freedom.

2.4.5. Bootstrap Method

The bootstrap approach is one popular resampling technique that is useful to obtain estimates of the standard errors, confidence intervals and p-values for test statistics. This method also helps to check the estimation results' stability. Under this approach, the sampling variability can be estimated by taking repeated samples from the original sample,

as if it comes from taking repeated samples from the population. According to Cameron and Trivedi (2005), the bootstrap method may give accurate results in large samples, thus, it can be asymptotically valid as the sample goes to infinity. Compared to the original standard intervals that are based on the normality assumption, the bootstrap method can produce more precise results.

The concise steps typically involved in a bootstrapping process are described below and discussed more fully in the following paragraphs:

(i) Resample the data.
One form of bootstrap that is commonly applied is performed by resampling the data randomly with replacement. With the replacement, we can draw randomly N observations from the N-observation dataset. As expected, there is the possibility of obtaining similar observations from the original sample.

(ii) Determine the bootstrapping statistic using the resampled dataset. During the bootstrapping process, these steps are repeated using a certain number of replications, which are determined by specific factors as explained below, resulting in the statistic recalculation.

(iii) Once a dataset of the recomputed statistics is obtained, we can calculate the standard error using the standard deviation of the bootstrap distribution.

Following the explanation in Poi (2004), if $\hat{\theta}$ denotes the observed value of the statistic that is computed based on the original dataset, and $i = 1,2, \dots, k$ represents the bootstrap samples (where k corresponds to the number of replications), then $\hat{\theta}_i$ is the value of the statistic from the ith bootstrap sample. We can estimate the standard error as in the equation below:

$$\widehat{se} = \left\{ \frac{1}{k-1} \sum_{i=1}^{k} \left(\hat{\theta}_i - \bar{\theta} \right)^2 \right\}^{\frac{1}{2}} \tag{2.10}$$

where

$$\bar{\theta} = \frac{1}{k} \sum_{i=1}^{k} \hat{\theta}_i$$

Moreover, the variance-covariance matrix is calculated correspondingly, and the bias is estimated as:

$$\widehat{bias} = \bar{\theta} - \hat{\theta} \tag{2.11}$$

Using the normal-approximation method, the confidence interval can be determined with the equation below:

$$\left[\hat{\theta} - z_{1-\frac{\alpha}{2}}\widehat{se}, \hat{\theta} + z_{1-\frac{\alpha}{2}}\widehat{se}\right] \tag{2.12}$$

where $z_{1-\frac{\alpha}{2}}$ is the $\left(1-\frac{\alpha}{2}\right)^{th}$ quantile of the standard normal distribution.

Among some factors that influence how precise the bootstrap distribution estimates are, two stand out, they are the number of observations in the original sample used and the total number of replications performed. In general, valid bootstrapped statistics might be achieved by performing more replications. However, despite the advantage of the bootstrap method, the time and cost involved call for a finite number of replications.

A technique to choose the number of bootstrap replications is explained among others by Andrews and Buchinsky (2000) and Poi (2004). Consider that we are interested in estimating standard errors which are represented by λ. In an ideal situation where we are not limited by any constraint like time or cost, we can perform large numbers of bootstrap replications and produce the bootstrap estimator $\hat{\lambda}_{\infty}$. In practice, finite replications are more sensible. If B represents the number of bootstrap repetitions, performing the finite replications, we obtain the set number estimator $\hat{\lambda}_B$. Naturally, we would prefer this to be as precise as possible with the value close to $\hat{\lambda}_{\infty}$. To obtain good estimates, we can choose the maximum discrepancy between $\hat{\lambda}_B$ and $\hat{\lambda}_{\infty}$ that we are willing to tolerate. This value is measured as the percentage deviation (pdb). In other words, the closeness of $\hat{\lambda}_B$ and $\hat{\lambda}_{\infty}$ is represented by the percentage deviation of $\hat{\lambda}_B$ from $\hat{\lambda}_{\infty}$:

$$100\frac{\left|\hat{\lambda}_B - \hat{\lambda}_{\infty}\right|}{\hat{\lambda}_{\infty}} \tag{2.13}$$

Therefore, determining the pdb level is essential to obtain the appropriate number of replications, where the acceptance level of percentage deviations from the optimal bootstrap is considered. A higher percentage of deviation refers to a lower number of replications. The typical value of pdb is 5% or 10%. Moreover, another way to reduce the number of replications is by setting a higher τ value, which indicates a higher acceptance level that the probability of the estimated statistic will deviate by the pdb value. As explained in Andrews and Buchinsky (2000), let pdb be a bound on the percentage

deviation of $\hat{\lambda}_B$ and $\hat{\lambda}_\infty$ and 1 - τ refer to a probability close to one, for instance 0.95. We are interested to determine $pdb = pdb(B, \tau)$ such that:

$$Pr\left(100\frac{\left|\hat{\lambda}_B - \hat{\lambda}_\infty\right|}{\hat{\lambda}_\infty} \leq \ pdb\right) = 1 - \tau \tag{2.14}$$

Furthermore, combining the 5% pdb setting with the τ=1%, means that with the probability of 99%, the bootstrapped standard error of the parameter is not allowed to deviate by more than 5% from the ideal bootstrapped values. Under this scenario, the bootstrap technique is performed by applying 1,326 replications.

Following this method, the estimation of the bootstrap size needed for the standard errors in this chapter will be based on a similar pdb and τ. Next, the number of replications will be adopted to obtain robust standard errors in the SUR estimation for the disaggregate capital flows, where the flows are separated into three categories: direct investment, portfolio investment and other investment flows.

2.4.6. Model Specification

In the literature on capital flow determinants, the well-known pull (domestic characteristic) factors and push (global) factors are often associated with the underlying idea of the portfolio balance approach, where the expected returns, risk, and risk preferences across countries are crucial for capital flows (Ahmed and Zlate, 2014; Ahmed Hannan, 2017). Related to this, Ghosh et al. (2012) also suggested that capital flow determinants from domestic factors influence the risks and returns to investors, and depend on local macroeconomic fundamentals, official policies and market imperfections.

The underlying theory used for the model specification in this study is consistent with the main views of the portfolio balance theory. If we let the foreign-owned stock of domestic capital k, depend on the relative rates of risk and return as follows:

$$\frac{k}{w} = k(r, r^*, d, w) \tag{2.15}$$

where $k_r > 0, k_{r^*} < 0, k_d < 0, k_w > 0$

w : stock of financial wealth

r : domestic interest rate

r^* : foreign rate of return

d : risk of the capital asset

The linearized version of the model below can be applied to the flows concept of capital in this chapter:

$$\Delta k = \alpha_1 \Delta w + \alpha_2 \Delta r + \alpha_3 \Delta r^* + \alpha_4 \Delta d \quad (2.16)$$

Motivated by the approach above, the exploration of the key drivers of capital flows in this study covers several relevant approximations. For instance: (i) the stock of financial wealth is proxied by GDP growth; (ii) the domestic interest rate is represented by domestic money market interest rates; (iii) the foreign rate of return is approximated by the US government bond yield and global money market interest rates; (iv) the risk of the capital asset is proxied by the global risk volatility index (VXO). These indicators, in addition to other relevant variables described in the previous section will be analysed further.

Another relevant theory on capital flows deliberated in the literature is the traditional neoclassical theory where economic development of a particular country has been an important concern when discussing capital flows. This theory predicts that capital flows from countries that possess more capital (more developed countries) to other less developed countries with lower stocks of capital per capita, under the assumption of free capital mobility. According to this theory, the capital movement occurs if there are comparable technologies and thus, uniform goods production with a similar constant returns to scale production technology (Alfaro et al., 2008). Furthermore, Ahmed Hannan (2018) analysed the connection between the concept of neoclassical theory with the push factors. This theory predicts that capital reacts to interest rate differentials between countries. Under this concept, capital flows from the low return countries to those that can offer high returns.

However, in practice, we see only limited capital flows in this direction, compared to what the classical theory would suggest. In the literature, it is known as the Lucas Paradox, which can be explained by two main factors: (i) factors that focus on the differences in the fundamental factors which influence the production structure of the economy, including differences in technologies, factors of production, and government policies, and (ii) factors that focus on capital market imperfections and asymmetric information. The rate of return is not the only consideration for the investor to invest more in a particular country. Other crucial concerns are the uncertainty levels and market failures. The Lucas paradox has generated an extensive literature, specifically related to the main drivers of capital flows direction. Reinhardt et al. (2013) for example, revisit the Lucas paradox and confirmed empirically the neoclassical theory, suggested that financial openness matters for capital flows, thus, capital inflows were experienced by less developed countries, while the outflows occurred in the more developed countries. Another study by Alfaro et al. (2008)

focused on the possible reasons for the Lucas paradox. They found the institutional quality as the main explanation for this paradox.

Based on the empirical literature, the push factors of capital inflows might include global growth, global interest rate, global liquidity, global risk, global commodity price, and other relevant global factors. The studies by Fernandez-Arias (1996), Calvo et al. (1996), Jevcak et al. (2010), and Byrne & Fiess (2016) emphasized the importance of global factors in attracting capital inflows, particularly to developing economies. On the other hand, the pull factors for capital inflows, can be originated from domestic economic growth, interest rate differentials, financial deepening in domestic markets, exchange rate movements, domestic inflation rates, credit growth, internal political risk, debt ratio, degree of capital account openness, trade openness, and other country specific aspects. Some studies have highlighted the role of domestic factors, e.g. Arias et al. (2016), Nier et al. (2014), Bruno & Shin (2014), Olaberria (2014), Dell'Erba & Reinhardt (2015), Hashimoto & Wacker (2016), and Iamsiraroj (2016). Most of these empirical results are in line with what the theory would suggest.

Following the previous literature and the basic concept of the related theories described above, this study accommodates 13 key drivers of capital inflows from both push and pull factors, in addition to the dummy crisis variable. The push (global) factors cover the US government bond yield, VXO index, global growth and broad money growth as defined by the IMF. On the other side, the pull (domestic) factors consist of real interest rate, financial development, exchange rate, political risk, financial openness, debt ratio, credit to private sector, trade openness, and GDP growth.

In line with the existing literature, with the exception of the debt ratio, a positive relationship is expected between capital inflows and the domestic factors. Therefore, an acceleration of capital inflows in the sample are expected to be driven by an expansion in economic growth, a higher level of financial development, a more open capital account (higher level of financial openness), a more integrated country with the global market (higher level of trade openness), higher credit to the private sector, an appreciation of the exchange rate, higher real interest rate, and lower political risk or higher institutional quality. Meanwhile, for the global factors, we may expect that capital inflows are positively linked to the broad money growth and global growth, but negatively connected to the US government bond yield and VXO index.

Based on the general panel model and the chosen variables described earlier, the following model will be estimated[6]:

$$Y_{it} = \alpha_i + \beta_{1it}Credit_{it} + \beta_{2it}Tr_{open}{}_{it} + \beta_{3it}D_{growth}{}_{it} + \beta_{4it}Fin_{open}{}_{it} + \beta_{5it}Debt_{it} + \beta_{6it}FD_{it} + \beta_{7it}ER_{it} + \beta_{8it}RIR_{it} + \beta_{9it}PR_{it} + \beta_{10it}G_{growth}{}_{it} + \beta_{11it}Gov_{bond}{}_{it} + \beta_{12it}VXO_{it} + \beta_{13it}Money_{it} + \beta_{14it}D_{crisis}{}_{it} + \varepsilon_{it} \quad (2.17)$$

where:

Y_{it}	: capital flow variables, consisting of (i) disaggregate investment (direct investment (DI), portfolio investment (PI) and other investment (OI)) and (ii) aggregate investment, that is defined as the sum of these three flow components.
Credit	: credit to private sector
Tr_open	: trade openness
D_growth	: domestic GDP growth
Fin_open	: financial openness
Debt	: gross debt
FD	: financial development
REER	: real effective exchange rate
RIR	: real interest rate
PR	: political risk
G_growth	: global growth
Gov_bond	: US government bond yield
VXO	: global volatility index (VXO index)
Money	: broad money growth
D_crisis	: dummy global financial crisis (GFC)

The estimation will be performed in two steps. In the first step, equation (2.17) is estimated using OLS, fixed effects (FE) and random effects (RE) to see the significance of the initial base variables. These three estimators are applied for comparison purposes. For the aggregate capital flows, this study relies on the first step estimation results and utilizes the Hausman test to choose between FE or RE model. When the RE model is recommended,

[6] Note that in the first step estimation of disaggregate capital flows, trade openness is only included in direct investment (DI) equation. The importance of trade openness as the one of the key drivers of DI flows has been previously discussed among others by Wei (2011) and Mercado and Park (2011).

an additional test is performed using the Breusch-Pagan Lagrange multiplier (LM). Under the null hypothesis, the variances across entities is zero, thus, there is no significant difference across units. A rejection of this null hypothesis suggests that RE model is more appropriate because it can deal with heterogeneity better compared to the OLS model.

The second step to be executed for estimating the disaggregate capital flows models is done by first, selecting the most relevant variables for each type of flows based on the estimation outcomes in the first stage. Here some insignificant variables are dropped from each equation based on the F-test results (for FE model) or Wald χ^2 test (for RE model). The test outcome reported in Table A2-3 in the appendices indicates that we fail to reject the null hypothesis that the coefficients are jointly significant at 5% level of confidence. Next, all models are re-estimated using the fixed effect (FE) with seemingly unrelated regression (SUR) estimator. This is due to the expected correlation in the residuals between equations. To check for this correlation, another test using the Breusch Pagan test for error independence is performed, in addition to the correlation matrix residuals.

As explained in the previous section, the system of equations in SUR should not contain exactly the same set of regressors (Zellner, 1962). Otherwise, the results from estimating the system jointly will be the same as from the OLS. Furthermore, given the nature of the capital flows, it is common to expect a cross correlation of the error terms between the equations of the capital flow components, which makes the OLS estimator become inefficient.

After the elimination process, different models and sub samples may include different sets of variables as described in the following equations:

1. Full sample

$$DI_{Full,it} = \alpha_i + \beta_{1it}Credit_{it} + \beta_{2it}Tr_{open_{it}} + \beta_{3it}D_{growth_{it}} + \beta_{4it}Fin_{open_{it}} + \beta_{5it}FD_{it} + \beta_{6it}ER_{it} + \beta_{7it}PR_{it} + \beta_{8it}G_{growth_{it}} + \beta_{9it}VXO_{it} + \beta_{10it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.18)$$

$$PI_{Full,it} = \alpha_i + \beta_{1it}Tr_{open_{it}} + \beta_{2it}Fin_{open_{it}} + \beta_{3it}Debt_{it} + \beta_{4it}FD_{it} + \beta_{5it}RIR_{it} + \beta_{6it}PR_{it} + \beta_{7it}Gov_{bond_{it}} + \beta_{8it}VXO_{it} + \beta_{9it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.19)$$

$$OI_{Full,it} = \alpha_i + \beta_{1it}Tr_{open_{it}} + \beta_{2it}D_{growth_{it}} + \beta_{3it}Fin_{open_{it}} + \beta_{4it}Debt_{it} + \beta_{5it}FD_{it} + \beta_{6it}ER_{it} + \beta_{7it}VXO_{it} + \beta_{8it}Money_{it} + \beta_{9it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.20)$$

2. Emerging economies

$$DI_{Eme,it} = \alpha_i + \beta_{1it}Credit_{it} + \beta_{2it}Tr_{open_{it}} + \beta_{3it}D_{growth_{it}} + \beta_{4it}Fin_{open_{it}} + \beta_{5it}FD_{it} + \beta_{6it}ER_{it} + \beta_{7it}PR_{it} + \beta_{8it}G_{growth_{it}} + \beta_{9it}VXO_{it} + \beta_{10it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.21)$$

$$PI_{Eme,it} = \alpha_i + \beta_{1it}Tr_{open_{it}} + \beta_{2it}Fin_{open_{it}} + \beta_{3it}Debt_{it} + \beta_{4it}FD_{it} + \beta_{5it}RIR_{it} + \beta_{6it}PR_{it} + \beta_{7it}Gov_{bond_{it}} + \beta_{8it}VXO_{it} + \beta_{9it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.22)$$

$$OI_{Eme,it} = \alpha_i + \beta_{1it}Tr_{open_{it}} + \beta_{2it}D_{growth_{it}} + \beta_{3it}Fin_{open_{it}} + \beta_{4it}Debt_{it} + \beta_{5it}FD_{it} + \beta_{6it}ER_{it} + \beta_{7it}PR_{it} + \beta_{8it}G_{growth_{it}} + \beta_{9it}VXO_{it} + \beta_{10it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.23)$$

3. Advanced economies

$$DI_{Adv,it} = \alpha_i + \beta_{1it}Credit_{it} + \beta_{2it}Tr_{open_{it}} + \beta_{3it}D_{growth_{it}} + \beta_{4it}Fin_{open_{it}} + \beta_{5it}FD_{it} + \beta_{6it}ER_{it} + \beta_{7it}PR_{it} + \beta_{8it}G_{growth_{it}} + \beta_{9it}VXO_{it} + \beta_{10it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.24)$$

$$PI_{Adv,it} = \alpha_i + \beta_{1it}Tr_{open_{it}} + \beta_{2it}Fin_{open_{it}} + \beta_{3it}Debt_{it} + \beta_{4it}FD_{it} + \beta_{5it}RIR_{it} + \beta_{6it}PR_{it} + \beta_{7it}Gov_{bond_{it}} + \beta_{8it}VXO_{it} + \beta_{9it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.25)$$

$$OI_{Adv,it} = \alpha_i + \beta_{1it}Credit_{it} + \beta_{2it}Tr_{open_{it}} + \beta_{3it}D_{growth_{it}} + \beta_{4it}Fin_{open_{it}} + \beta_{5it}Debt_{it} + \beta_{6it}ER_{it} + \beta_{7it}PR_{it} + \beta_{8it}G_{growth_{it}} + \beta_{9it}VXO_{it} + \beta_{10it}Money_{it} + \beta_{11it}D_{crisis_{it}} + \varepsilon_{it} \quad (2.26)$$

2.4.7. Unit Root Test

Before estimating the empirical models, panel unit root tests are performed for all variables using the Fisher-type unit root tests as discussed in Choi (2001) and Baltagi (2005). Besides being acceptable for unbalanced panel data, this test also works for data series with gaps. In this chapter, the Fisher-type test is applied using the Augmented Dickey-Fuller (ADF) tests. Choi (2001) suggests that some other benefits of this test come from the more common assumptions used compared to other tests. This test applies to both finite and infinite numbers of panels, also every panel may contain stochastic and non-stochastic

elements. Moreover, the panels are assumed to have different durations and this test can accommodate panels with unit roots and others without unit roots.

In Fisher-type unit root tests, the ADF unit-root tests is conducted on each panel. The null hypothesis states that all panels contain unit roots, while in contrast, the alternative hypothesis specifies at least one panel is stationary.

Table 2-4. Unit Root Test Results of the Key Drivers of Capital Inflows

Dependent Variable	Statistic	P-Value
Direct Investment	-10.32	0.000
Portfolio Investment	-13.28	0.000
Other Investment	-13.06	0.000
Aggregate Investment	-9.75	0.000
Independent Variable	**Statistic**	**P-Value**
Domestic Factors		
Credit to Private Sector	-18.99	0.000
Trade Openness	-2.87	0.002
Domestic GDP Growth	-18.44	0.000
Financial Openness	-8.35	0.000
Debt	-1.25	0.106
Financial Development	-4.10	0.000
Real Effective Exchange Rates (REER)	-7.01	0.000
Real Interest Rate	-11.61	0.000
Political Risk	-14.45	0.000
Global Factors		
Global Growth	-14.45	0.000
US Government Bond Yield (1st differenced)	-37.93	0.000
VXO	-26.21	0.000
Money Growth	-14.76	0.000

Notes: H0: All panels contain unit roots; Ha: At least one panel is stationary; a trend term is included to account for the trend stationarity; the stationarity test is based on the inverse normal (Z) statistics.

Except for the US government bond yield variable, the test results indicate small p-values for all dependent and independent variables, suggesting a rejection of the null hypothesis. Therefore, aside from the US government bond yield (which is converted further into a first difference variable), no further data transformation is required. This fits the characteristics of the variables which are measured in percentage and index form. The unit root test results

are summarized in Table 2-4[7]. Moreover, as discussed in Choi (2001), among several statistics available in the Fisher-type unit root tests, the Z test has a superior performance relative to the other tests (L*, P, Pm). Therefore, the author suggested that the inverse normal (Z) statistic is suitable in empirical work. Moreover, the Z test can also be used for finite and infinite N.

2.5. Estimation Results

The estimation results of the chosen push and pull factors of capital inflows and outflows are presented in this section. The sample covers 92 countries (Table A2-1) over the period 1990 to 2015. Due to the data availability, some variables may have more observations than others. The aggregate and disaggregate models of capital inflows are estimated using different estimators. As explained in the methodology, the aggregate flow model is estimated using the ordinary least squares (OLS) and fixed effects (FE) or random effects (RE) estimator, depending on the Hausman test results. In the case when RE is recommended, the Breusch-Pagan Lagrange multiplier (LM) test helps to decide between the RE and OLS estimator. Next, this approach is referred as the first step estimation in this chapter. Whilst the disaggregated models are estimated using the bootstrapped fixed effects with seemingly unrelated regression (FE with SUR). These different estimators are applied because of the expected residuals correlation between the three equations, given the nature of each type of the flows (direct investment (DI), portfolio investment (PI) and other investment (OI)). This step will be referred as the second step estimation in the next discussion.

Before estimating the disaggregate flows models using the FE with SUR estimator, the Breusch and Pagan test for error independence is applied. The results presented in Table 2-5 suggest a statistically significant correlation between the errors in the three equations. Hence, in this case, using SUR estimator is more appropriate as this will give more efficient estimation results.

[7] Similar unit root tests have also been performed for the disaggregated samples. The results showed analogous outputs for all variables in both emerging and advanced economies. All variables are stationary in levels, except for the US government bond yield in both economies and trade openness variable in advanced economies. These two indicators are stationary in the first difference.

Table 2-5. The Correlation Matrix of Residuals and BP Test for Error Independence

		Direct Investment	Portfolio Investment	Other Investment
Full Sample	Direct Investment	1.000		
	Portfolio Investment	-0.008	1.000	
	Other Investment	0.201	0.052	1.000
	Breusch-Pagan test of independence: chi2(3) = 46.661, Pr = 0.0000			
		Direct Investment	**Portfolio Investment**	**Other Investment**
Emerging Economies	Direct Investment	1.000		
	Portfolio Investment	-0.156	1.000	
	Other Investment	0.082	-0.018	1.000
	Breusch-Pagan test of independence: chi2(3) = 20.781, Pr = 0.0001			
		Direct Investment	**Portfolio Investment**	**Other Investment**
Advanced Economies	Direct Investment	1.000		
	Portfolio Investment	0.041	1.000	
	Other Investment	0.263	0.097	1.000
	Breusch-Pagan test of independence: chi2(3) = 33.572, Pr = 0.0000			

To account for heteroskedasticity, the aggregate flow model is estimated with the robust standard errors option. Moreover, following the bootstrap approach as in Cameron and Trivedi (2005), robust standard errors are obtained in the FE with SUR estimations when estimating the disaggregate flows. As noted in the methodology, the number of replication is based on the approach of Poi (2004). By choosing τ=1% and the percentage deviation (pdb)=5%, the bootstrap technique is applied using 1,326 replications.

Next, some insignificant variables in the first step estimation (using OLS and FE or RE estimator) are eliminated from the equations based on the F-test (for FE model) or Wald χ^2 test (for RE model). The outcomes from the first step estimation for aggregate flow and the second step estimation for disaggregate flows will be discussed in this section[8]. For

[8] To examine the possibility of endogeneity, another estimation was performed to explore an alternative specification by including only the lagged explanatory variables. The result suggests that the most important key drivers in the contemporaneous model are also statistically significant in the lagged estimations. At the aggregate level for example, the consistent drivers of capital flows are

comparison purposes, the results of disaggregate flows from the first step estimation (using similar OLS and FE or RE estimators) are presented in the appendices (Table A2-4 to Table A2-6).

2.5.1. Direct Investment Inflows

Applying the bootstrapped FE with SUR estimator for disaggregate inflows, the results are presented in Table 2-6. From the full sample, the estimation results suggest that direct investment inflows are strongly driven by a number of domestic factors, as well as by global factors. The influence of the domestic indicators appears to outperform the push factors for this type of flow. From the domestic factors, the key drivers are coming from all three categories: (i) external exposures (trade openness and financial openness), (ii) macroeconomic fundamentals (exchange rates) and (iii) other domestic drivers (financial development and political risk). Whereas from the global factors, the global risk aversion, represented by the VXO index and dummy global financial crisis (GFC) are the most influential determinants of capital inflows in this sample.

The external exposure that is represented by financial openness indicates that countries with more open capital accounts also experience bigger inflows from direct investment. In this case, the financial openness indicator is positively significant, such that an increase of one point in the financial openness index leads to the direct investment flows to rise by 0.67% relative to GDP.

This result is also consistent with Olaberria (2014), Sarno et al. (2016), Hashimoto & Wacker (2016), and Byrne & Fiess (2016) who reviewed the increasing assimilation of the

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shown to be the global volatility (VXO), financial market development and political risk, particularly in the case of emerging economies, which also influences the results in the full sample. Similarly, those indicators are also important for all types of flows at disaggregate level in the full sample and emerging economies with two exceptions. Those are the political risk in the OI estimation and the financial market development in the PI estimation that are significant for the advanced economies. An interesting finding in the lagged model estimation is the interest rates indicators, which are no longer significant for emerging economies.

major emerging economies within the global financial markets. In addition, trade openness is considered as an important indicator by the international investors in the aggregate sample. Here, a 1% increase in trade openness relative to GDP is associated with a 0.04% increase in direct investment flows relative to GDP. Trade openness suggests that countries with higher levels of integration in the global market receive more inflows. This result supports previous study by Milesi-Ferretti and Tilee (2011) who suggest a strong relationship between the world capital flows and world trade openness. Moreover, Iamsiraroj (2016) found that trade openness was an important determinant of foreign direct investment.

Table 2-6. FE with SUR Estimation Results – Direct Investment

Direct Investment	**Full Sample**	**Emerging Economies**	**Advanced Economies**
Domestic (Pull) Factors			
Credit to Private Sectors	0.020	0.016*	0.034
	(0.012)	(0.009)	(0.032)
Trade Openness	0.038**	0.012	0.059
	(0.016)	(0.015)	(0.057)
Domestic GDP Growth	-0.016	-0.072	0.075
	(0.048)	(0.051)	(0.100)
Financial Openness	0.667***	0.372**	1.698***
	(0.207)	(0.161)	(0.583)
Financial Development	9.142***	6.469**	11.647***
	(2.255)	(3.061)	(2.884)
REER	0.014**	0.008	0.049**
	(0.007)	(0.008)	(0.021)
Political Risk	0.056*	0.077**	-0.081
	(0.031)	(0.032)	(0.074)
Global (Push) Factors			
Global Growth	0.174	-0.020	0.600**
	(0.122)	(0.127)	(0.253)
VXO	-0.042*	-0.058**	0.001
	(0.024)	(0.029)	(0.045)
Dummy GFC	2.395***	2.565***	2.645**
	(0.625)	(0.716)	(1.188)
Constant	-7.446***	-5.212**	-9.114
	(2.268)	(2.202)	(5.883)
Observations	1,078	660	418
χ^2 test (Prob > χ^2)	0.000	0.000	0.000

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; robust standard errors are obtained by bootstrapping the estimations with 1,326 replications.

Similarly, the countries with deeper financial market development also can attract more inflows from direct investment. In addition, higher direct investment is associated with a stronger currency, represented by an appreciation of the exchange rates. The positive relationship is consistent with the literature, such as Dell'Erba & Reinhardt (2015) who suggested a higher real effective exchange rate is associated with higher FDI flows.

In addition to financial openness, financial development and political risk as in the full sample, credit to the private sector and political risk can also be considered as important variables from the domestic factors in emerging economies. The latter finding suggests that a 1% increase in credit growth could raise direct investment inflows relative to GDP in emerging countries by 0.02%. However, this indicator only shows a relatively weak influence, being significant at only the 10% level. The previous studies that explored the relationship between surges in capital inflows with the credit indicator have been conducted among others by Broto et al. (2011), Baek & Song (2016), and Amri et al. (2016).

Furthermore, the political risk indicator in this study is used as a proxy for domestic country risk which is also related to political stability. The significant parameter estimate of this indicator indicates a large concern of the foreign investors for the domestic political stability in the investment destination countries. A positive parameter estimate is associated with a lower political risk or a higher political stability, hence may attract higher capital inflows. The relationship of this index with capital flows has been studied previously, such as by Le and Zak (2006), Alfaro et al. (2008), Fratzscher (2012), Olaberria (2014), Hashimoto & Wacker (2016), and Byrne & Fiess (2016). As an example, Le and Zak (2006) suggested that instability in the domestic political condition is the most influential indicator associated with capital flight.

From the global factors, DI in emerging economies has been significantly affected by the global risk volatility indicator, which is approximated by the VXO index. The influence of this indicator in emerging economies is relatively stronger compared to the one in the full sample. As expected, the negative estimated parameter suggests that when the global stock markets become more volatile, less DI will enter emerging economies. The main intention of the investors in this type of flow is typically related to an expectation of establishing a long-term relationship, as well as getting a significant degree of influence in the management of the enterprise. Hence, the risk indicator is usually carefully considered. Some recent literature has emphasised the role of this variable for capital inflows, such as Olaberria (2014) who suggested that capital inflows to emerging markets are strongly

related to global risk aversion. In addition, Nier et al. (2014) observed that stock market volatility is one of the substantial push factors associated with capital inflows into emerging countries. Given the nature of this indicator, in the short term, a low level of volatility in the stock market is a preferable sign to the investor considering expanding their investment abroad.

Moreover, the variable 'crisis', which captures the effect of the global financial crisis 2007-2008, is statistically significant in all economies. Compared to advanced economies, the impact is more significant in emerging economies. The positive relationship might be related to the uncertain global conditions around those periods, so that the emerging economies could offer a better environment for foreign investors. In addition, the crisis originated and was more sustained in developed economies.

Several similar findings are found for DI flow determinants in advanced economies. Variables like financial openness, financial development and the crisis indicator which have been important for DI flows in the aggregate sample and emerging economies also show a consistent influence in advanced countries. Lastly, the global growth only shows a significant impact in these economies, although it does not affect the findings in the full sample.

In summary, both domestic and global indicators matter for direct investment flows into emerging and advanced economies. Nevertheless, limited indicators from the global factors are found to be influential in this study, aside from the crisis indicator, only the global stock market volatility is important for emerging economies and only global growth is crucial for advanced economies. The dominance of pull factors for direct investment flows has been highlighted in previous studies, such as by Fratzscher (2012), particularly in Emerging Asia and Latin America, even though his study is more related to net capital flows. Lastly, we can notice that the financial openness and financial development have been the most consistent key drivers of direct investment in all of the samples.

2.5.2. Portfolio Investment Inflows

The estimation results displayed in Table 2-7 suggest that the strong domestic drivers of portfolio investment inflows are financial development and the gross debt ratio over GDP, in addition to the global stock market volatility and global financial crisis variable from the global factors. The parameter estimates of these indicators are consistently significant in emerging and advanced economies, as well as in the aggregate sample. Hence, the results

in the aggregate sample for these types of flows seem to be affected by both economies, rather than dominated by a certain group of countries.

As expected, factors like financial development are crucial for the foreign investor, indicating that portfolio investment inflows are strongly driven by the depth of the financial market. This result is in line, for example with Lusinyan (2002), who suggested that the depth of financial market development is one of the main determinants of portfolio investment flows. Moreover, countries may obtain more PI inflows when they have lower general government gross debt. The estimation output suggests that a 1% increase in gross debt ratio to GDP could lead to a 0.03% and 0.06% decrease in portfolio investment flows relative to GDP in emerging and advanced economies respectively. As explained in the previous section, the foreign investors generally consider the country's indebtedness before allocating their investment. Countries with disproportionately large debt levels are perceived as more vulnerable economies, besides diminishing the domestic bond's attractiveness to foreign investors (Milesi-Ferretti and Tilee, 2011). Therefore, the negative sign in the estimation result implicates that the countries tend to receive higher capital inflows when the government debt is at a safe level and presumably face a lower risk of default. This finding is aligned with other studies such as with Nier et al. (2014) who suggested a negative relationship between general government debt and capital inflows in general (excluding the FDI).

In addition to those pull drivers, the push drivers also play an important role. For example, the VXO index, which represents the volatility in the global stock market is the most important indicator for attracting PI inflows both in emerging and advanced economies. It suggests that foreign investors consider the perceived risk and uncertainty in the expectations in the global stock market before deciding to increase portfolio investment in advanced countries. This result is in line with the recent study among others by Cerutti et al. (2015) and Arias et al. (2016) who found that international financial market volatility is negatively connected with portfolio inflows. In addition, Forbes & Warnock (2012) and Baek & Song (2016) also suggest that global risk is strongly associated with extreme capital flow episodes. In addition, this finding is not surprising, because obtaining a significant return is the main goal of the investors who invest in portfolio investment. The intention of investing in portfolios is mostly focusing on the earnings from investment activities, such as from purchasing and selling the shares or other securities. Thus, the global risk factor, especially in the stock market always becomes an important consideration.

Besides the domestic factors explained above, portfolio investment in emerging economies is also driven by political risk. Again, this finding suggests that the risk variable has been proven to be one of the major concerns of the foreign investors. Unlike in emerging economies, PI in advanced economies is significantly affected by the financial openness indicator, which captures the extent and intensity of capital controls. Therefore, countries with a lower intensity of capital control or more open financial accounts may expect to obtain higher PI inflows, which in this case are represented by countries in advanced economies.

Table 2-7. FE with SUR Estimation Results – Portfolio Investment

Portfolio Investment	Full Sample	Emerging Economies	Advanced Economies
Domestic (Pull) Factors			
Financial Openness	0.136	-0.146	1.030**
	(0.150)	(0.114)	(0.423)
Debt	-0.037***	-0.025***	-0.061***
	(0.008)	(0.008)	(0.014)
Financial Development	10.062***	5.964***	14.762***
	(1.657)	(1.969)	(3.161)
Real Interest Rates	0.004	-0.003	0.092
	(0.013)	(0.011)	(0.073)
Political Risk	0.043**	0.059***	-0.039
	(0.021)	(0.020)	(0.074)
Global (Push) Factors			
US Government Bond	-0.008	0.043	-0.231
	(0.192)	(0.184)	(0.354)
VXO	-0.076***	-0.071***	-0.097***
	(0.018)	(0.017)	(0.037)
Dummy GFC	-1.275***	-0.789**	-2.130**
	(0.418)	(0.328)	(0.941)
Constant	-2.754*	-3.273*	-0.893
	(1.546)	(1.670)	(5.189)
Observations	1,078	660	418
χ^2 test (Prob > χ^2)	0.000	0.000	0.000

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; robust standard errors are obtained by bootstrapping the estimations with 1,326 replications.

The variable crisis in this model is found to be statistically significant in all economies. The negative sign indicates that a higher level of international financial instability causes a lower portfolio investment flow into these economies. This is opposite to the result reported earlier with respect to FDI. Compared to the DI, portfolio investment flows are typically

less persistent. Hence, this flow may move across countries more frequently under unfavourable condition. Unexpectedly, the domestic interest rate does not appear to be a significant driver for PI, which challenges the standard portfolio assumption. A previous study on the relationship between portfolio investment flows and interest rate differentials by Arias et al. (2016) also suggested the same outcome. Similarly, the foreign bond yield does not show a substantial influence with this particular flow in our sample. These findings indicate that the investors of PI flows appear to be more affected by other indicators rather than the rate of returns.

2.5.3. Other Investment Inflows

The results in Table 2-8 implies that domestic and global factors are important for OI inflows in both economies. In emerging economies, the main determinant of OI is also consistent with the key driver of DI and PI, where financial development and global market volatility are found to be statistically significant. In contrast, more diverse indicators are essential for OI in advanced economies. The growth of domestic GDP shows a very strong influence on OI inflows in both economies, suggesting that the foreign investors pay substantial attention to the measurement of how fast national economic output is growing.

The estimation outcomes also suggest that there are wider factors affecting this inflow. Economic growth has consistently driven OI in these countries, as suggested by how influential the domestic and global growth are, although the latter only shows a relatively weak connection. In this case, a 1% rise in domestic growth can be associated with a 0.28% and 0.84% increase in other investment flows relative to GDP in emerging economies and advanced economies respectively. The important role of global growth is also found by Forbes & Warnock (2012). Their study concluded that global growth was able to predict capital flows in extreme episodes, particularly during surges, stops and retrenchment periods, which respectively refers to a sharp increase and decrease in capital flows, and a sharp increase in capital outflows. In addition, variable like political risk in advanced economies is only noteworthy for this inflow, but not for DI and PI. Finally, the least significant indicator from the pull factors for OI inflows in this sample is the exchange rates.

Furthermore, compared to emerging economies, OI in advanced economies is strongly affected by the push factors. Besides the global growth and global financial market volatility, global liquidity, as approximated by the money growth, is also found to be an essential driver for OI. This finding, therefore, confirms the important role of global banks

in cross-border monetary transmission in developed countries. Given the heterogeneous nature of this flow, that contains components such as trade credit, loans and bank deposits, this result is not surprising.

Table 2-8. FE with SUR Estimation Results – Other Investment

Other Investment	Full Sample	Emerging Economies	Advanced Economies
Domestic (Pull) Factors			
Credit to Private Sectors			0.088*
			(0.052)
Domestic GDP Growth	0.483***	0.284**	0.844***
	(0.110)	(0.111)	(0.266)
Financial Openness	0.185	-0.411	1.293
	(0.425)	(0.253)	(1.256)
Debt	-0.079***	-0.065*	-0.033
	(0.028)	(0.038)	(0.037)
Financial Development	19.597***	11.509*	
	(4.350)	(6.683)	
REER	0.028	0.012	0.117*
	(0.021)	(0.021)	(0.062)
Political Risk		-0.050	0.467***
		(0.129)	(0.172)
Global (Push) Factors			
Global Growth		-0.319	1.274**
		(0.345)	(0.566)
VXO	-0.210***	-0.185***	-0.282***
	(0.053)	(0.063)	(0.102)
Money Growth	0.764***		1.108**
	(0.231)		(0.431)
Dummy GFC	2.687	3.979**	6.064*
	(1.689)	(1.574)	(3.605)
Constant	-7.537*	4.771	-57.388***
	(4.551)	(9.901)	(15.789)
Observations	1,078	660	418
χ^2 test (Prob > χ^2)	0.000	0.000	0.000

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; robust standard errors are obtained by bootstrapping the estimations with 1,326 replications.

2.5.4. Aggregate Inflows

As mentioned in the previous section, the analysis of aggregate inflow determinants is based on the results from the first step of the estimation. This flow was calculated by summing all three components of inflows (direct investment, portfolio investment and

other investment). For this reason, the drivers include all the combined indicators used in the disaggregate flows estimation. Table 2-9 presents the outputs from the fixed effect (FE) and random effect (RE) estimator. Although the Hausman test recommends one result from the two estimators, both are displayed for comparison[9]. The two estimators have their own advantages and disadvantages. Despite its advantages in considering the unobserved heterogeneity, the FE estimation has a weakness as it could not capture the cross-sectional differences between countries, because FE is focusing on catching the variation within the individual countries. Nor can it easily capture the impact of variables which tend to change only slowly over time. This weakness is covered in RE, since RE estimation treats the unobserved heterogeneity as random and assumes it is uncorrelated with the explanatory variables. Thus, RE has the ability to pick up the cross-sectional differences across countries. However, RE also has a drawback, where the strong assumption about the uncorrelated errors with the independent variables may potentially bias the parameter estimates in the model. Based on the Hausman test, the FE estimator is selected for the full and advanced economies sample, while RE is chosen as a better estimator for emerging economies. In the case where RE is selected, an additional test is performed using the Breusch-Pagan Lagrange multiplier (LM) to help decide between the RE and OLS estimator. The test outcomes are presented in Table A2-7 in the appendices. It suggests that compared to OLS, RE is a better estimator for all of the tested equations.

The estimation result indicates that at the aggregate level, capital inflows to emerging economies are caused by both pull and push factors. Although more pull factors are found to be significant, the VXO index and crisis variable from the push factors shows the strongest effect, being significant at the 1% level. In these countries, all push indicators discussed above are consistently important for attracting all types of disaggregate flows. The relationship between pull factors for capital inflows in emerging economies was suggested earlier among others by Baek & Song (2016) who implied that domestic factors are more strongly connected with emerging countries. Whilst the importance of the push factors was also implied for example by Byrne & Fiess (2016), who underlined the importance of global factors for international capital movements into emerging markets.

Comparing the drivers of aggregate and disaggregate flows, some indicators show a consistent performance, particularly in the case of emerging economies. For example, the

[9] The recommended results from Hausman test are marked as described on the notes of the corresponding table.

domestic political stability (political risk), the depth of financial market development (financial development index) and the global volatility indicator (VXO). These variables are statistically significant for DI and PI flows.

Table 2-9. Fixed and Random Effects Estimation Results – Aggregate Investment

	Full Sample		Emerging Economies		Advanced Economies	
	FE *)	RE	FE	RE *)	FE *)	RE
Domestic (Pull) Factors						
Credit to Private Sectors	0.020	0.065*	0.018	0.032	0.061	0.143**
	(0.048)	(0.038)	(0.040)	(0.039)	(0.089)	(0.062)
Trade Openness	-0.087	0.081**	-0.058	-0.001	-0.092	0.146**
	(0.068)	(0.041)	(0.047)	(0.025)	(0.104)	(0.072)
Domestic GDP Growth	0.267	0.176	-0.041	-0.102	0.941*	0.573
	(0.272)	(0.289)	(0.241)	(0.265)	(0.515)	(0.689)
Financial Openness	2.042	1.234	-0.035	0.319	6.652	2.227
	(1.697)	(0.818)	(0.591)	(0.424)	(4.734)	(1.803)
Debt	-0.096	-0.078	0.012	0.012	-0.211	-0.108
	(0.076)	(0.051)	(0.064)	(0.046)	(0.137)	(0.073)
Financial Development	52.275**	23.753*	38.791*	23.479*	54.029	23.470
	(23.706)	(12.461)	(20.371)	(13.962)	(39.123)	(21.130)
REER	0.043	0.083**	0.044*	0.050**	0.188	0.172
	(0.043)	(0.041)	(0.024)	(0.021)	(0.136)	(0.121)
Real Interest Rates	-0.037	-0.027	-0.132**	-0.133**	0.484	0.350
	(0.119)	(0.101)	(0.059)	(0.061)	(0.686)	(0.783)
Political Risk	0.060	0.118	0.185	0.240*	0.105	0.523*
	(0.150)	(0.110)	(0.143)	(0.135)	(0.350)	(0.288)
Global (Push) Factors						
Global Growth	0.784*	0.974**	-0.266	-0.280	2.262*	2.809**
	(0.413)	(0.422)	(0.293)	(0.288)	(1.323)	(1.271)
US Government Bond	0.878	1.519	0.462	0.538	0.450	1.575**
	(0.964)	(0.941)	(1.452)	(1.501)	(1.095)	(0.771)
VXO	-0.317***	-0.249***	-0.343***	-0.349***	-0.458	-0.430*
	(0.119)	(0.078)	(0.118)	(0.113)	(0.342)	(0.226)
Money Growth	0.994**	0.919*	0.294	0.131	1.278*	1.657***
	(0.417)	(0.488)	(0.537)	(0.559)	(0.629)	(0.586)
Dummy GFC	4.928**	5.757**	6.169**	6.887***	7.653*	8.977*
	(2.192)	(2.345)	(2.525)	(2.658)	(4.386)	(5.223)
Constant	-11.911	-23.554**	-9.597	-12.217	-44.683	-82.205***
	(13.100)	(9.994)	(12.831)	(9.573)	(40.043)	(31.663)
Observations	1,099	1,099	681	681	418	418
Prob > F or Prob > χ^2	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; *) the recommended results from Hausman test & BP LM test; standard errors are obtained based on the robust variance estimator.

Furthermore, apart from the crisis indicator, the last two variables are also important for OI flows. Therefore, we can conclude that most of the major drivers of aggregate inflows are also important for DI PI and OI flows in emerging economies, although in the latter flows, only two significant variables are similar. This finding suggests that the main determinants of aggregate flows are mostly in line with the less volatile types of disaggregated flows.

However, for aggregate flows, very limited significant determinants are found in the case of advanced economies. Although the RE estimator reports more important determinants, the Hausman test recommends the result from the FE estimator. In this sample, aside from the crisis indicator, only domestic growth, global growth and global liquidity matters for the foreign investors. Hence, at the aggregate level, capital inflows in advanced economies are mostly driven by the push factors. Nevertheless, the influences are not very strong, being statistically significant at the 10% level. The effect of those indicators, however, are stronger in disaggregate investment level, particularly for OI flows. The dominance of the push factor role in advanced countries was discussed in earlier studies such as by Sarno et al. (2016). They suggested a stronger affect originates from the push factors compared to pull factors, specifically related to portfolio flows.

In contrast to the expected results, a paradoxical result is obtained from the role of the real interest rate in aggregate flow estimation for emerging economies, as it shows a negative parameter estimate[10]. This result challenges the standard assumption that capital inflows, generally have a positive connection with the interest rates. Nevertheless, the coefficient of this indicator is very small. A similar relationship was also suggested among others by Arias et al. (2016) who found that capital inflows have a negative, long-term association with the interest rate differential, although this was related to the FDI flows. They referred to this relationship as a puzzling finding. One of the possible reasons for our finding in this case might be related to the Lucas paradox argument, which suggests that capital flows do not always flow from more developed to less developed countries. According to this concept, the direction of the flows can be explained by factors that focus on the differences in the fundamental factors including differences in technologies, factors of production, and government policies; and factors that focus on capital market imperfections and

[10] For a comparison purposes, another estimation at aggregate level has been completed using similar approach as in the disaggregate flows. Once the insignificant variables are eliminated based on the F-test (for FE model) or Wald χ^2 test (for RE model), consistent outcomes are obtained for most main indicators. However, the real interest rate is no longer statistically significant for emerging economies.

asymmetric information. Additionally, other factors included in this concept are uncertainty levels and market failures. Hence, the rate of return is not the only consideration for the investor to invest in a particular country.

2.6. Conclusion

The important role of capital inflows has been discussed in a growing literature, along with its inherent risks. Despite all the benefits offered, capital inflows also bring some challenges for the authorities. Managing the inflows, their direction, as well as their volatility is unavoidable with the increasing global integration, otherwise, if it is not well managed, the literature has suggested that domestic financial stability might be potentially threatened. Therefore, identifying the key drivers of capital inflows is a crucial step to understanding their behaviour, and furthermore, to provide indications for constructing an effective policy mix and safeguarding the financial system stability. In particular, the policy formulation can be emphasized in accordance with these findings, whether it should be focusing more on domestic or global factors.

Using extensive panel data on gross capital inflows and its related variables in emerging and advanced economies during the last 26 years, this chapter explores the major drivers of aggregate and disaggregated capital inflows based on domestic (pull) and global (push) factors. The disaggregated capital inflows are analysed because they may respond to the drivers in different ways. Due to the expected correlation between the residuals across equations, the estimation of disaggregated inflows is performed using bootstrapped FE with SUR. Whilst for aggregate inflows, the estimation is accomplished using the FE and RE estimator or OLS, depending on the Hausman and Breusch-Pagan LM test results.

Comparing the results in emerging and advanced economies, we notice that at the aggregate level, capital inflows in emerging economies can be associated with the domestic (pull) factors and limited global (push) indicators. Three domestic factors are consistently important for emerging economies, they are financial development, exchange rates and political risk. From the global factors, indicators like VXO, in addition to the crisis variable also show a strong influence. On the contrary, aggregate inflows in advanced countries indicate a close link to the global factors. Apart from the crisis indicator, global growth and global liquidity are important for these flows. From domestic factors, GDP growth is the only indicator that matters for the investors.

Moreover, the empirical outputs suggest that different types of flows are driven by different sets of indicators. Nevertheless, there are some common drivers across the flows in all sub samples (emerging, advanced and all economies). The most important variables for DI flows consist of financial openness and financial development. The estimation outcome also indicates that DI flows have a stronger relationship with the pull factors than push factors. Furthermore, the finding from PI flows estimation is also in line with DI flows. Although both pull and push factors are influential in all sub samples, domestic indicators have shown strong influences. The debt and financial development for example, are statistically significant at the 1% level. The influence of global indicators on the other side is more limited. Aside from the crisis variable, only global financial market volatility (VXO) seems to consistently affect the PI flows across all the sample set. Finally, from the OI flows estimation, a more diverse finding has emerged. The most consistent drivers are demonstrated by the domestic GDP growth and VXO indicator. In addition, other significant variables vary across economies. From these results, we can summarize the most consistent driver of DI and PI flows is due to the financial development. Whilst when focusing on the PI and OI flows, the VXO indicator becomes the common driver across economies.

Based on these empirical findings, this study shows the importance of disaggregation. This is on two dimensions, firstly with respect to emerging economies and more advanced economies. There are significant differences and a one size fits all approach, as can be found in the literature, is not appropriate. The second dimension relates to disaggregating inflows rather than analysing them collectively. Again, the results suggest that the factors that drive direct investment are not, for example the same as those which drive portfolio investment. Nonetheless, the FE with SUR approach suggests an interconnectedness between the error terms. The positive correlations between those residuals suggests that there are factors, possibly random events, which contribute in making all types of inflows more attractive to investors.

Statement of Authorship

<table>
<tr><td colspan="4">This declaration concerns the article entitled:</td></tr>
<tr><td colspan="4">The Impact of Capital Flows on Indonesia's Macroeconomic Performance</td></tr>
<tr><td colspan="4">Publication status (tick one)
Draft manuscript [X] Submitted [ ] In review [ ] Accepted [ ] Published [ ]</td></tr>
<tr><td>Publication details (reference)</td><td colspan="3"></td></tr>
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Formulation of ideas: 100%

Design of methodology: 100%

<s>Experimental work:</s>

Presentation of data in journal format: 100%</td></tr>
<tr><td>Statement from Candidate</td><td colspan="3">This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.</td></tr>
<tr><td>Signed</td><td>Trinil Arimurti</td><td>Date</td><td>3 January 2020</td></tr>
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Chapter 3. The Impact of Capital Flows on Indonesia's Macroeconomic Performance

3.1. Introduction

Recent financial liberalization has increased the opportunity for a rise in capital mobility between countries around the world. The large flows of foreign capital over the last few decades have brought significant benefits to the recipient country's economies in many ways. Each type of capital flow, according to the literature (i.e IMF, 2009; OECD, 2008) can promote different advantages. The foreign direct investment (FDI) for example, may transfer some additional contributions like advanced technology, as well as managerial and marketing knowledge. Correspondingly, the OECD (2008) pointed out that FDI can encourage financial stability, economic development, as well as boost public welfare. Moreover, FDI promotes larger opportunities for the host economy to go to the international market, thus, supporting the development of international trade. Another major type of flows, portfolio investment (PI) also can help to promote deeper domestic capital market development.

Despite the benefits gained, capital inflows also carry a number of challenges. The policy makers especially, need to pay more attention to the unfavourable impact from any surge in capital inflows. Reflecting on past experience, fast-growing capital inflows that exceeded the domestic economic capacity lead to the deterioration in some economies. One of the causes of the economic crisis faced by Indonesia in 1997/1998, as suggested by Goeltom (2008), was partly due to the enormous short-term capital inflows. Without being supported by proper economic capacity development, the inflows could not be optimally absorbed, so led to a deterioration in the economy. A hefty reliance on foreign funding had worsened the domestic financial system in some cases, and in line with weak corporate governance, it had led to relapses in consumption growth, as well as rising inflation, and a current account deficit. With prudential principles having the main attention, in the post-crisis period, Indonesia's economy has been able to recover with a higher resistance to global shocks.

3.1.1. Rationale of the Study

In line with the global economic development, the integration and interdependence between economies becomes ever more inevitable. In such a situation, there has been a growing policy interest in studying how the relationship would affect small open economy countries.

As with many other countries in this category, Indonesia is highly exposed to the global economic conditions. Consequently, its domestic economic performance might also be influenced by the condition in other countries, particularly the most interconnected ones. As described in Warjiyo (2012), recent challenges to global commodity price fluctuations and volatile capital flows have significantly affected the Indonesian economy as one of the commodity exporter countries. These impacts can be observed on domestic inflation, as well as on the economy's external sectors. This chapter empirically examines whether capital flows have delivered a substantial impact on Indonesia's economy using a structural vector autoregression (SVAR) model. This approach has been widely used in developing macroeconomic models, as it offers flexibility in imposing restrictions. These restrictions can be established based on the theory and historical data. Using this method, the relationship between variables can be explored by examining the effect of shocks to certain variables on other variables in the model. Additionally, to account for the escalating research interest in the interdependence of economies (in this case is between Indonesia and the US and Japan), the recent approach of the two-country SVAR allows us to examine how economic conditions in one country may affect another economy. Both countries are also well known as influential economic players in the global economy.

3.1.2. Objectives and Contribution

This study is focusing on exploring the international influences on the Indonesian economy through the financial flows. In other words, this study intends to examine how capital flows affect the macroeconomic performance in Indonesia. The analysis will be concentrated on the impacts of two capital flow shocks: the foreign flows shock (spillover-effect) and the domestic flows shock. To fulfil this purpose, two different approaches are applied, the single and the two-country Structural Vector Autoregressive model (SVAR). While the first approach analyses the global factors in the model, the latter accommodates the influences of the US and Japan. These two countries are chosen based on their role as Indonesia's main trading partners. Several key macroeconomic indicators are included in the model, such as inflation rates, interest rates, and the growth of GDP, export, credit and the exchange rates.

Furthermore, the capital flows are disaggregated into two categories: (i) direct and portfolio investment flows; and (ii) other investment flows. This disaggregation is based on the different characteristics between the two types of flows, where the first one is typically associated with long-term investment, and the latter is commonly associated with short-term investment. The specific characteristics of both flows have been previously discussed

among others by Habib and Venditti (2019) and Bruno et al. (2012). While direct and portfolio investments are known as more steady types of flows, other investment is commonly associated to the flows with higher volatility and more sensitive to a risk shock. A study by Broner et al. (2013) empirically showed that other investment had severely dropped in high income countries around the crisis periods during 2008-2009. Furthermore, according to Milesi-Ferretti and Tilee (2011), compared to other types of flows, due to its sensitivity to risk perception, the banking flows (one of the components of other investment) experienced the hardest knocked, following capital flows shrinking periods after the global financial crisis. This was specifically occurred in the countries that relied the most on the bank flows.

Based on the main objective in this study, further research questions to follow up are: (i) how does a shock to domestic capital flows affect Indonesia's economy under the single-country SVAR approach? (ii) how does the shock impacts in point (a) compared to the ones in the two-country SVAR model? (iii) do the shocks on capital flows to the US and Japan deliver substantial spillover effects on Indonesia's economy? comparing the two-country SVAR models, which one show a more significant influence? (iv) after the disaggregation, how does the impact from the direct and portfolio investment flows shock differ from other investment flows shock?

This chapter contributes to the literature mainly by the application of the more recent two-country SVAR framework in exploring the impact of capital flows. In constructing the models, this study modifies the multiple-country SVAR by Dungey and Fry (2000), by taking into account the influence of capital flows variables and concentrating the analysis on two countries. Most discussions in this area have been focusing on the single-country SVAR method, such as in Raghavan et al. (2014) and Hwa et al. (2017). Similarly, this is also the case for Indonesia, as the investigation of how capital flows may affect the economy has been completed using the same single-country SVAR approach. For example in Jayasuriya and Leu (2017) and Simorangkir (2006) that utilized the single-country SVAR model in their studies. Another approach used in Indonesia's study involved also analysing the descriptive statistics of relevant indicators like in Goeltom (2008) and Titiheruw and Atje (2008).

As the two-country SVAR models include US and Japan, in constructing the models, several economic indicators from both countries are incorporated. By considering the influence of both countries in the model, this framework allows us to investigate the spillover-effect from the US and Japan's capital flow shocks to Indonesian economy, which

has not been discussed yet in the previous studies. Another important contribution is, instead of focusing only on the aggregate capital flows, this chapter also explores the impact of disaggregated flows shock, which are categorized into two components: (i) direct and portfolio investment flows and (ii) other investment flows. This way, we can investigate whether different type of flows deliver similar impacts on Indonesia's economy. Additionally, this study covers large number of observations, exploring quarterly data from 1990q1 to 2016q4.

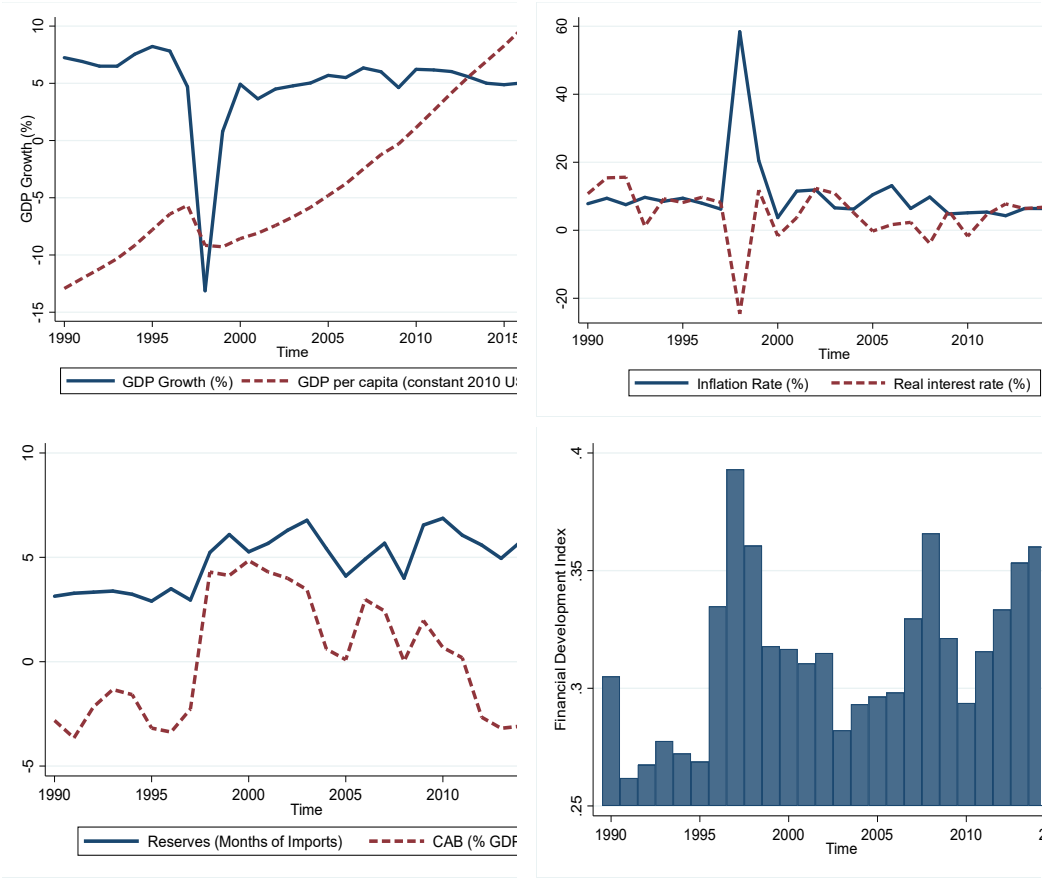
3.1.3. Outline of the Chapter

The first section of this study portrays a brief background on the history of Indonesia's economic performance and capital flow dynamics, along with a short description on the rationale and the objectives of the study. Subsequently, the next section presents the literature review, which mainly discusses more on the related theory and empirical evidence from the existing studies. Concisely incorporated in this section are the policies related to the application of capital flow management in Indonesia during the observation periods. Following this, the observations, data measurement and variables included in the estimation are explained in section 3. Major macroeconomic indicators in Indonesia, in addition to the global factors and relevant variables from the main trading partners are summarized in this section. Thereafter, in section 4, the research methodology is elaborated in more detail, comprising both the single and the two-country Structural Vector Autoregressive (SVAR) approach. Additionally, section 5 describes the estimation results, presenting the estimation outputs from both the aggregate and disaggregate flows. Lastly, this study ends with the conclusions in section 6.

3.1.4. Indonesia's Economic Performances in the Pre- and Post-Crisis Periods

As with many other small open economies involved in rapidly evolving international economic integration, Indonesia has been unexceptionally influenced by global sentiments. Among some of the global shocks over the last few decades, the one that hit Asian countries in 1997/1998 had an extraordinary impact on the Indonesia's economy. Some indicators from the World Development Indicators (WDI) are presented in Figure 3-1 showing how this crisis had rapidly damaged the Indonesia's economy.

Figure 3-1. Indonesia's Macroeconomic Indicators, 1990-2016



Source: World Development Indicators (WDI), IMF, Author's calculations.

Compared to the pre-crisis period, the economic growth during the crisis period fell significantly and hit a very low point of -13.13% in 1998. In line with this, the real GDP per capita also fell significantly and touched a low of USD 2,071 in 1999. Indonesia also experienced an extremely sharp rise in the inflation rate, the highest point was 58.39% in 1998, which lead to a negative real interest rate during this period. Some other indicators had already shown a fragile performance since the pre-crisis period. Among others are the low position of international reserves, the volatile current account balance, and the shallow capital market development during the pre-crisis period which had significantly contributed to the economic vulnerability. Given this fact, the exchange rate turmoil spread rapidly through the economy and turned into an economic crisis. Many companies defaulted on their foreign debt and went bankrupt because of the worsening rupiah exchange rate at that time. The crisis sequentially triggered a capital flow reversal, leaving the domestic economy even worse off. The big picture of Indonesia's economic performances during the pre-crisis, crisis, and post-crisis periods is displayed in Table 3-1, where the average of each indicator is presented in each period.

Anticipating a further deterioration in the economy, some necessary policies were implemented immediately. The authorities intended to bring down the inflation rate and stabilize the Rupiah exchange rate by applying an exceptionally tight monetary policy, resulting in a sharp rise in the domestic interest rate. Furthermore, the exchange rate regime was switched from a managed float to a floating exchange rate system in 1997. The exchange rate system in Indonesia is stated in terms of US Dollar currency. To date, the system has been adjusted several times. The first system used was the fixed exchange rate system, which was applied up to November 1978, followed by the managed floating exchange rate system until August 1997 and finally the floating exchange rate system which has been implemented since then. Furthermore, in the earlier period before the crisis, one of the reasons for adopting the managed floating exchange rate system was related to the export growth policy. In line with the higher degree of openness of the Indonesia's economy, the volume of capital inflows continued to increase during this period, particularly the short-term flows, which forced the central bank to widen the intervention band, and in turn to switch to the free-float exchange rate system.

The implemented policy changes during the crisis in turn helped to gradually improve the macroeconomic fundamentals. The recovery phase started to take place during the early 21st century. The exchange rate was less volatile from 2002 onwards, the inflation rate fell dramatically from the highest point to as low as 3.72% in 2000 according to the WDI database. Although highly affected by government policy through fuel subsidy reduction, the inflation rate, was still manageable.

GDP also grew more strongly after the crisis, however, it was slightly lower compared to the level before the crisis. In line with this, the real GDP per capita continued to rise. Likewise, the current account balance improved in the post-crisis period. According to the IMF (2017), capital inflows had an essential role in financing the Indonesia's current account deficits. Even though it remained in a deficit from 2012 onwards, the negative size was getting smaller over time, yielding a positive balance on the average value. In line with this, the capital inflows have also helped to finance the fiscal deficits, allowing the Indonesian government to meet the budget's requirement by issuing more government securities. Furthermore, the international reserve position has been stronger after the crisis, covering up to 5.74 months of the cost of imports. The real interest rate, which represents the real lending rate, on average, was not as high as before the crisis period.

In addition to the influence of the global economic conditions, reformation of several regulations by the Indonesian authorities, like in the capital markets, the prudential

guideline principles on lending activities and the exchange rate system, have played an important role in explaining the relatively lower performances of the other indicators, such as domestic credit to the private sector, financial development, and the exchange rate after the crisis periods.

Table 3-1. Indonesia's Macroeconomic Indicators, 1990-2016 (Average Value)

Indicator	Pre-crisis	Crisis	Post-Crisis
	1990-1996	1997-1999	2000-2016
GDP growth (annual %)	7.25	-2.55	5.29
Current account balance (% of GDP)	-2.59	2.05	0.75
Domestic credit to private sector (% of GDP)	51.88	44.89	28.43
Real interest rate (%)	10.01	-1.52	4.55
Inflation, consumer prices (annual %)	8.62	28.37	7.17
Total reserves in months of imports	3.25	4.76	5.74
Market capitalization of listed domestic companies (% of GDP)	36.48	27.45	34.27
GDP per capita (constant 2010 USD)	2,001.35	2,196.38	2,936.93
Official exchange rate (LCU per USD, period average)	2,094.54	6,926.05	9,992.67

Source: World Development Indicators, Author's calculations.

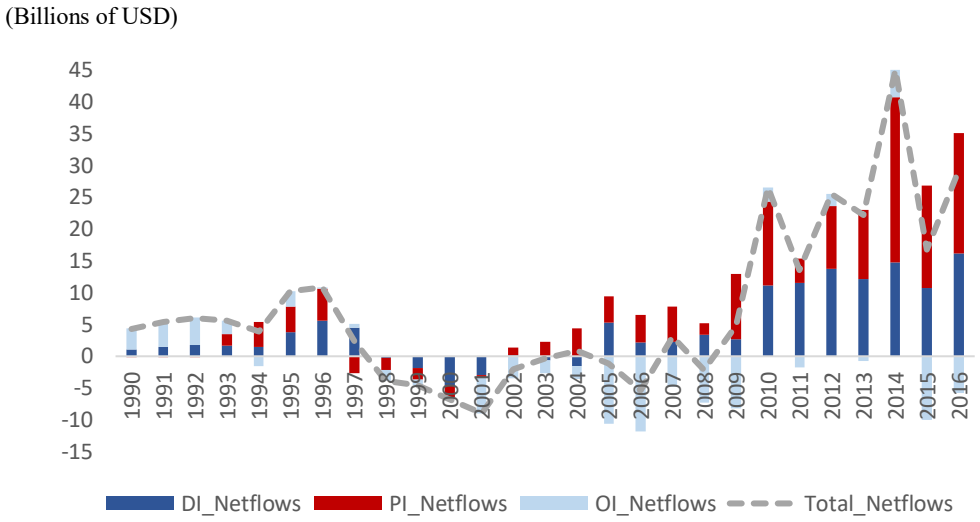
3.1.5. Developments in Indonesia's Capital Flows

In line with global economic dynamics and a higher degree of financial openness, Indonesia's economic performance, and the liberalisation of the domestic financial sector, all played an essential role in promoting the rapid expansion of capital flows into Indonesia before the mid-1990s. The average capital inflows (the sum of direct investment, portfolio investment and other investment) into Indonesia during 1990-1996 reached 6,918 million USD. After deducting the outflows, the netflows are still as high as 6,608 million USD. However, capital flows during the early of 1990s were marked by the dominance of other investment, which has been known as the most volatile type of flows. Characterized more by short-term flows, the capital flows brought some consequences. The property sector suffered from asset price bubbles. A vast credit expansion was also observed during that period. In the situation of inadequate corporate governance and an intense reliance on the external sector, Indonesia's financial stability were vulnerable to the crisis, which hit Asian countries in 1997/1998 (Goeltom, 2008).

Comparing the performance between the first and last decades of the observation period as in Figure 3-2, on average, total netflows have increased substantially from 2,915 million USD during 1991-2000 to 16,311 million USD in 2000-2016. With regards to the

composition of these flows, in the later periods, the dominant component has shifted from other investment to direct investment and portfolio investment.

Figure 3-2. Capital Flows to Indonesia (Billions of USD), 1990-2016



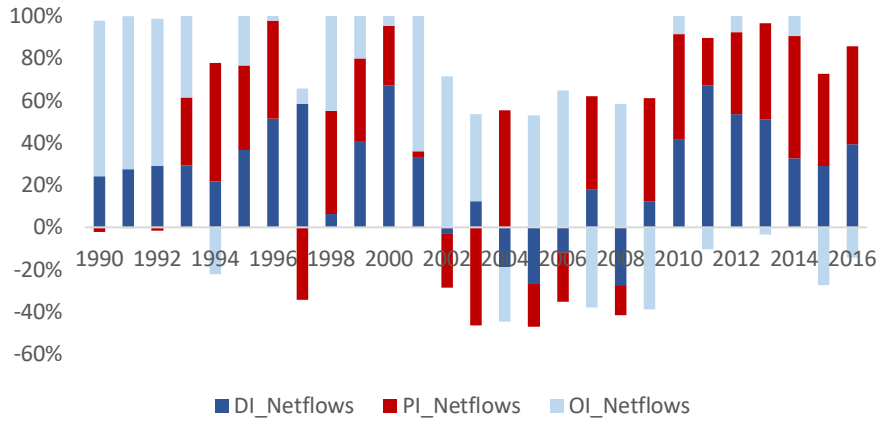
Source: International Financial Statistics (IFS), author calculations

Based on the shares of capital flows composition, these changes are displayed in Figure 3-3. The portion of direct investment and portfolio investment has risen sharply in the recent periods. Particularly after the global financial crisis, this structure has remained stable. It is certainly preferable, as both investments are known as a longer term and more stable type of flow. Among others, Bruno et al. (2012) and Habib and Venditti (2019) discussed the specific characteristics of both flows. In contrast to other investments that are commonly associated with the flows, they have higher volatility and are more sensitive to a risk shock, direct and portfolio investments are accepted as being more steady types of flows. On average, excluding the crisis period, during 1990-1997, the ratio of net capital flows to GDP was 3.76%. In the latter time, since 1998 to 2002, following the Asian financial crisis, Indonesia experienced massive capital flight, which brought the net flows to their lowest position of -1.77%.

Recovering from the downturn, capital flows into Indonesia started to record a gradual improvement in the period after this, specifically since the recent financial crisis (Figure 3-4). Over 2010-2016, it reached 2.92% of GDP. As reported by the IMF (2017), the capital flow dynamics in Indonesia during these periods were influenced by some major global incidents, such as the Euro area sovereign debt crisis in late 2011, the taper tantrum by the Federal Reserve in 2013, and the reformation in China's exchange rate policy in 2015. Apart from the global sentiments, the IMF (2017) also underlined the importance of other factors,

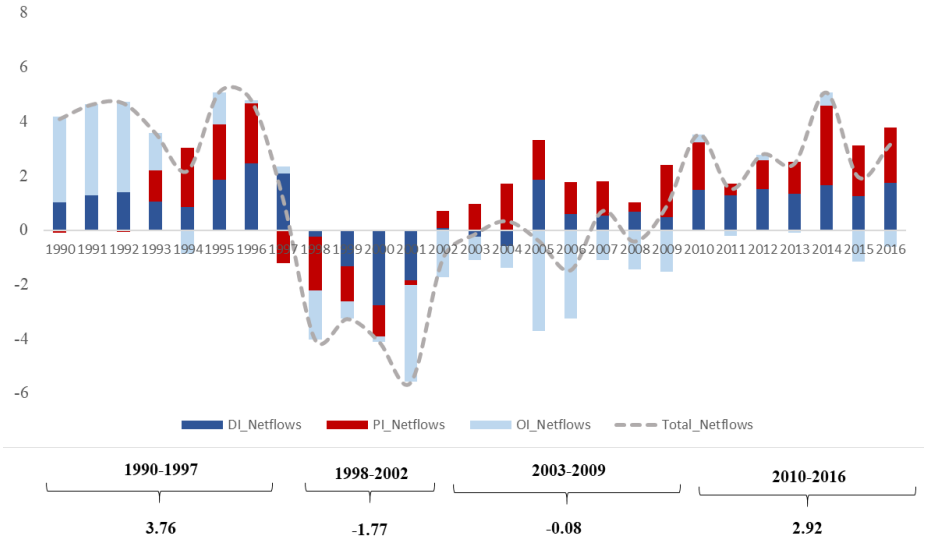
such as domestic economic growth and interest differentials between Indonesia and the US. For portfolio investment for example, the foreign investors are more interested in getting higher income as a result of the higher yield of government bonds.

Figure 3-3. The Shares of Capital Flows to Indonesia (%), 1990-2016



Source: International Financial Statistics (IFS), author calculations

Figure 3-4. The Average of Capital Flows to Indonesia (% of GDP), 1990q1-2016q4

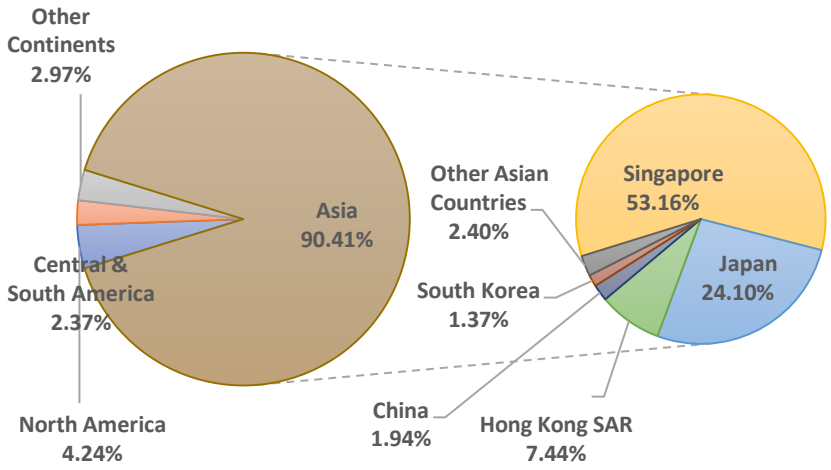


Source: International Financial Statistics (IFS), author calculations

Based on the country of origin, capital flows, in this case is specifically for direct investment to Indonesia were dominated by Asian investors, which reached 90.41% in

2015[11]. As presented in in Figure 3-5, from this share, 77.26% were from Singapore and Japan, and the rest were invested by the investors from Hong Kong SAR, China and South Korea. Additionally, other foreign investors countries were North America, Central and South America, and other regions.

Figure 3-5. Direct Investment by Major Investor Countries (%), 2015

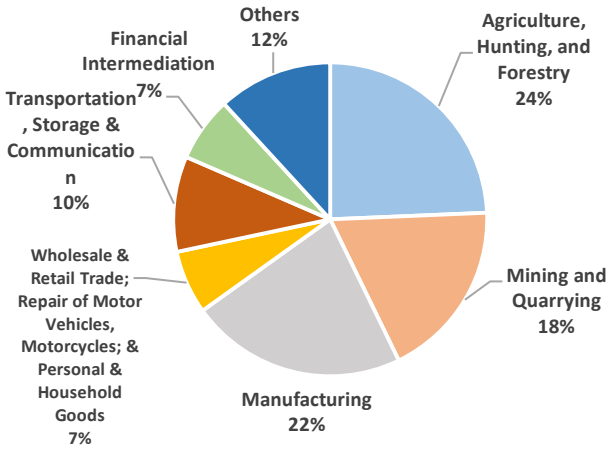


Source: Bank Indonesia (BI), author calculations.

Furthermore, among other types of capital flows, in term of the benefits by promoting economic growth, most countries typically preferred to have a higher proportion of foreign direct investment (Bosworth and Collins (1999). This advantage in particular can be achieved under the assumption that the investment projects are productive. In Indonesia, these direct investment flows have been distributed to the most productive sectors, mainly to the agricultural, hunting and forestry (24%), manufacturing (22%) and mining and quarrying sectors (18%), as presented in Figure 3-6.

[11] Note that although capital flows in Indonesia are dominated by portfolio investment and direct investment, only the latter is discussed more in this section. This is due to the limitation of data availability for other types of investment obtained from Bank Indonesia's website (www.bi.go.id).

Figure 3-6. Direct Investment by Major Economic Sectors (%), 2015



Source: Bank Indonesia (BI), author calculations

3.1.6. The Drivers of Capital Inflows to Indonesia

Typically, key drivers of capital flows in the literature are categorised into two main categories, the pull and push factors groups (see, e.g., Forbes and Warnock (2012), Fratzscher (2012), IRC Task Force (2016)). While the push factors refer to the global influences such as global liquidity and global risk aversion, the pull factors represent the domestic indicators that attract the capital flows into the receiving countries, like the macroeconomic fundamentals, institutional framework, and the government policies (IMF, 2017). In Indonesia, existing studies implied that both pull and push factors are important drivers. The IMF (2017) suggested that the capital flows to Indonesia are highly influenced by the cyclical factors, which are represented by the difference of GDP growth and interest rate between Indonesia and the US. Moreover, the global risk aversion is also found to be another significant factor, in particular for the portfolio investment type of flows. These findings are obtained based on a panel study of 34 countries using country fixed effects during the 2009-2015 period of observations. In another estimation using the GARCH model, in addition to the global risk aversion, the domestic economic indicators like the exchange rate appreciation and the higher bond yield spread are shown to be crucial for attracting more financial flows to Indonesia.

Before the crisis hit Indonesia in 1997-1998, Goeltom (2008) observed several important internal and external factors for capital inflows in this country. The surge in capital inflows at that periods are associated with the good performance of the domestic economy, reflected

in the upward GDP growth, low level of inflation, and stable exchange rates. On the other hand, from the external factors such as the wider interest rates differential, along with the economic recession in many advanced economies like in the US, Japan and European countries were also affecting the direction of the flows. From the policy side, reformation in the exchange rate system, from the previous more restricted exchange rate system (fixed exchange rate system) to managed float exchange rate system from1978 to mid-1997, before implementing the floating exchange rate system since then.
This adjustment together with the next deregulations on the banking system and capital market are considered as other crucial factors for the capital inflows to Indonesia. The deregulation in the banking system led to the significant expansion in banking activities, including liberalisation in the permission of establishing the foreign banks in Indonesia.

Another study by Titiheruw and Atje (2008) from the ADB Institute explored several possible indicators for capital inflows to Indonesia. Focusing on the pull factors side, capital inflows to Indonesia were related to the improved domestic macroeconomic performance, after it had deteriorated during the Asian economic crisis. In addition to the higher short-term interest rate differential, indicators like the increasing economic growth, controllable inflation, gradually smaller fiscal deficits, and declines in the overall external debt have potentially driven the financial inflows during these periods.

3.1.7. Indonesia's Main Trading Partners: US and Japan

As we aim to explore two different approaches to answering the objectives of this study, the second methodology involves a second country’s influence when analysing the impact of capital flows on Indonesia's macroeconomic performance. Thus, in the two-country SVAR approach, the countries with the highest trading values in terms of exports and imports have been selected.

According to the most recent trading data from World Integrated Trade Solution (WITS) developed by the World Bank, together with the United Nations Conference on Trade and Development (UNCTAD), International Trade Center, United Nations Statistical Division (UNSD) and the World Trade Organization (WTO), Indonesia's main trading partners in terms of the exports and imports values in 2016 are listed in Table 3-2. Regarding net exports, Indonesia's total value of exports (FOB) reached USD 144,490 Million during that period, while the total value of imports (CIF) accumulated to USD 135,653 Million. Next, the shares of each country in the top 5 list is calculated based on these values.

Table 3-2. Indonesia's Top Trading Partners, 2016

No	Partner Country	Millions USD	Shares (%)
Export			
1	China	16,786	11.62
2	US	16,171	11.19
3	Japan	16,102	11.14
4	Singapore	11,246	7.78
5	India	10,094	6.99
Import			
1	China	30,800	22.71
2	Singapore	14,548	10.72
3	Japan	12,985	9.57
4	Thailand	8,667	6.39
5	US	7,319	5.4

Source: World Bank-World Integrated World Solution (WITS)

Based on the net values, after subtracting the exports and imports, the US and Japan delivered the highest net export values, amounting to USD 8,852 million and USD 3,117 million respectively. Although China was in first position, due to the limitations in the availability of the data, our two country SVAR model will be focused only on the US and Japan. According to the IMF criteria, both countries are classified as advanced economies. Thus, in addition to the US, also analysing the influence of Japan as one of the most developed countries in the Asian region will be beneficial.

3.2. Literature Review

3.2.1. The Impact of Capital Flows on the Economy

As globalization has fostered a greater degree of free capital mobility across countries, growing research has been focusing on observing the impact of the surge in capital flows to economies. This attention is closely related to the volatile characteristics of capital flows, which are mostly associated with emerging economies. In general, the studies suggest that based on the countries experiences, capital flows, besides offering huge benefits, might potentially deliver more risk, in the absence of an adequate level of domestic financial system development.

Discussion on how capital flows may affect the economy have been previously done but to a limited extent. In the global sense, among others is the research by Cardarelli et al. (2010)

who used a large sample of 52 countries including advanced and developing economies and found that the episodes of large capital inflows between 1987–2007 can be linked to a weakening in the current account balance, an appreciation of the exchange rates and a temporary acceleration of GDP growth, although it declined sharply in the later periods. Another study performed by Calderón and Kubota (2012) who concluded that surges in capital inflows had driven credit booms in the 70 advanced and emerging economies during 1975-2010. Compared to other types of capital inflows, the credit booms are mainly connected with other investment. FDI on the other hand can help to mitigate these occurrences. In line with this study, Benigno et al. (2015) categorized their sample into 70 middle and high-income countries during the 1975-2010 observation period, they also found that capital flows had generated credit booms. An interesting view of the relationship between capital flows and credit booms was suggested by Amri et al. (2016). They argued that although large capital inflows can lead to a significant money supply expansion which in turn are followed by credit booms, this is not always the case. The different measures used to identify the surge episodes of capital flows and credit is one of the issues that are discussed further in their findings.

Furthermore, Aizenman et al. (2013) using a sample of 100 countries suggested their main finding was the relationship between FDI and growth during 2 decades of observations during 1990-2010. Combes et al. (2010) used data from 42 countries to analyse the relationship between capital inflows and the exchange rate during 1980-2006. Disaggregating the capital inflows into public and private inflows, this study found that both inflows have triggered an appreciation in the real effective exchange rate. Moreover, compared to other types of inflows in private inflows, the most significant impact is produced by portfolio investment. In addition, the appreciation effect become smaller when the exchange rate is more flexible. A recent study performed by Igan and Tan (2015) also disaggregated the capital inflows into 3 categories, FDI, portfolio investment and other investment. A sample of 33 countries globally between 1980–2011 were examined and yielded several conclusions on the influence of capital inflows on credit growth. The non-FDI inflows appeared to encourage credit growth and at the same time, increase the possibility of credit booms in the household and corporate sector. Separating the behaviour between household and corporations when analysing credit growth such as in this study is very important. In addition to the inflow composition being the only important factor determining household credit, financial systems are found to be similarly significant for corporate credit. Another finding from this study is related to a strong relationship between speedy credit growth and other inflows, irrespective of the sectors and financial systems.

More research in this area, has been conducted by the IMF, Blanchard et al. (2015), focused on the emerging economies alone, using recent observations from 2010 onwards in 19 emerging markets. The analysis, however, is based on both the theory and empirical evidence, which differentiates the flows into bond and non-bond flows. When associated with the GDP growth, the non-bond inflow is proved to be more important than the bond flows, as the non-bonds effect is statistically significant in a positive direction. Additionally, when linked to credit, none of the flows produced an influential impact. After further disaggregation, the significance can be explained by the negative and significant impact of Foreign Direct Investment (FDI) flows in the non-bond flows, which suggests that there is a funding replacement possibility from banks to FDI. Other flows in addition, are found to have substantial and significant impacts on credit.

With a smaller scope, among the studies on Asian countries, Baharumshah and Thanoon (2006) concentrated their research only on FDI inflows into 8 East Asian countries, including China during 1982 to 2001. The findings verified the important role of FDI for domestic growth in both the short and long-term. Countries with larger FDI in turn, can attract more investment and promote a higher level of economic growth. In addition to economic growth, the analysis of how capital inflows affect the exchange rates has also been very popular in emerging Asian countries. A study by Jongwanich and Kohpaiboon (2013) for example, conducted on 9 emerging Asian countries during a relatively short time period from 2000-2009, applied disaggregated capital flows in their estimations, the main finding is the importance of portfolio investments. This type of flow can increase more quickly the speed of appreciation in the exchange rate compared to FDI. In addition, when comparing the impact of capital inflows with the outflows in all types of flows, the latter is proved to push the exchange rate adjustment further. Similarly, focusing more on the volatility of real exchange rates, Al-Abri and Baghestani (2015) performed their study using a sample of eight emerging Asian countries during 1980–2011. The higher the position of foreign liabilities caused a lower exchange rate volatility in some countries like China, India, Malaysia, Singapore, and South Korea. However, a contradictory finding was obtained in Indonesia, the Philippines and Thailand. A recent empirical study by Caporale et al. (2017) also aiming to explore a connection between capital flows and exchange rate volatility, using high frequency (monthly) data of seven Asian emerging countries during 1993–2015 they discovered a strong link between the high volatility of the exchange rate and equity flows, except for the Philippines. On the other hand, a low exchange rate volatility is associated with bond flows from Asian countries to the US.

In Indonesia, the analysis of the impacts of capital flows has been focused on specific time frames, such as in the pre-crisis, during crisis, and after crisis periods. As an example, the study by Goeltom (2008) was concentrating on the pre-crisis periods before 1997/1998, aiming to find out whether or not capital inflows have been constructive for the economy. In line with massive capital inflows during that period, Indonesia has managed to record high economic growth (averaged at 7.2% during 1989-1996), a significant increase in GDP per capita from USD 596 in 1990 to USD1,155 in 1996, manageable levels of average inflation (below 10%), a low level of unemployment (4.9%), and increasing international reserves (which reached USD 17.8 billion in 1996). The further development was also marked by a shifting in the dominance of the economic sectors, from agricultural to the manufacturing sector. Furthermore, after the exchange rate system was reformed from the managed float into the floating system, large capital inflows at that time led to the Rupiah's appreciation, maintained within the central bank's intervention band. However, interest rate differentials were maintained at a competitive level due to the pressure on the demand for foreign funds. In the later period, the imposed risks from the large capital inflows led to further international pressures on the economy. In line with the vulnerable domestic financial system, the initially favourable conditions turned into an economic and financial catastrophe. Given the lack of adequate regulation, supervision and institutional framework in the financial system, there was a massive intervention in credit allocations, and insufficient banking and prudential regulations. The rapid Rupiah appreciation, in addition, started to deteriorate the current account balance. Moreover, the expansion in the money supply sequentially led to overheating of the economy, when the aggregate demand grew higher than the economic capacity could absorb. As predicted, capital flight was inevitable, forcing the economic downturn even further down during the crisis period.

In further research, Simorangkir (2006) applied an SVAR approach to examine how trade openness and financial openness affected the Indonesia's economy by utilizing quarterly observations from 1980 to 2005. The financial openness is represented by the ratio of capital inflows over GDP. Several indicators of the Indonesia's macroeconomy are also included in the model, comprising GDP, the degree of openness, the interest rate, CPI, exchange rate, labour force, capital inflows, exports and imports. Also, capital inflows in this research are restricted to two types of flows, FDI and portfolio investment. As to the results, both indicators, the trade openness and financial openness showed a negative effect on output. The author suggested that the finding on financial openness in particular indicated that a higher degree of financial openness is correlated with more vulnerability to a capital flow reversal, which in turn can affect output.

Titiheruw and Atje (2008) from the ADB Institute analysed the stylised facts on the Indonesia's economy and observed the connection between large financial inflows and some domestic indicators between 1997–2007. This paper suggested that the net capital inflows perceived since 2002 were aligned with the appreciation in the real exchange rate, the increasing trend of inflation, as well as the rising in asset prices, as reflected in the JSX index (Indonesia's stock prices) and the property price index. On the other hand, the domestic banks had to face a higher exposure to foreign exchange risk, originating from external debt and indirectly from the acceleration in credit growth.

In more recent years, during 2010-2013, Warjiyo (2012) described how capital inflows, together with volatile global commodity prices affect the economy and the policy mix in Indonesia. The first focus was from 2010 to August 2011, when Indonesia experienced large capital inflows for FDI and portfolio investment. In this period, Indonesia experienced strong economic growth and credit growth, and a rising inflation rate. Also, the Rupiah's value was appreciating against the US dollar. Furthermore, Indonesia benefited from a surplus in both its current account and financial account, before it recorded a deficit in the last quarter of 2011. Next, from the end of 2011 to the beginning of 2012, the inflation rate was still manageable at a low level, below the target set by the central bank. However, as the European crisis became more severe, a massive capital flow reversal was inevitable, and in turn, led to a deterioration in the Rupiah exchange rates. Lastly, between 2012 and 2013, the capital flow reversal continued and led to further pressure on the exchange rates, as well as in money market liquidity. Therefore, a policy mix in terms of the monetary and macroprudential policies was implemented to mitigate any further destructive impacts on the Indonesia's economy.

In another policy paper, Warjiyo (2014) explained more about the relationship between portfolio investment inflows and the dynamics of the Rupiah exchange rate. This type of flow in Indonesia, by definition, is characterised by the dominance of government bonds and corporate equities, which have directly influenced the Rupiah exchange rate movement, as well as the domestic interest rate, and bank lending. Moreover, how capital inflows impact on the Indonesia's economy is also discussed further in Warjiyo (2015), by specifically focusing the analysis between 2009 and 2015, when Indonesia was significantly affected by uncertainty in the global economy and the volatility in the global financial markets. In parallel with the quantitative easing policy in some of the advanced economies like the US, Japan and European countries, Indonesia benefited from huge capital inflows during 2009 to 2011. High economic growth, a low inflation rate, a surplus

on the current account and an appreciation of the exchange rate are among the advantages from the capital inflows. Thus, the large financial inflows, together with the rise in global commodity prices played an essential role in these economic achievements during this period. However, in the later periods after 2011, as the global commodity prices went down, and a normalisation policy in the US occurred, Indonesia had to face higher pressures on the exchange rate, as well as in the exports, a current account deficit, and the risk of capital flow reversal. Next, Indonesia's growth fell to more moderate levels, achieving 5.2% on average during 2013-2015, from 6.3% during 2010-2012. To deal with these risks and challenges and given the lack of development in the domestic capital markets, the authorities decided to implement a set of policies, including monetary policy, macro-prudential policy, and capital flow management.

Salebu (2014) in addition, applying a panel data analysis during the period of 2004-2013 found that the FDI has helped to boost economic growth in Indonesia, although when the flows were disaggregated into sectoral data, not all of the sectors suggested a significant positive contribution to GDP growth. A recent study by Jayasuriya and Leu (2017) was also aimed at exploring the performance of the Indonesia's economy under a scenario of volatile capital flows, after the 1997 crisis periods. This research exemplifies the importance of international influences in modelling the Indonesia's economy. A single-country SVAR framework was applied using quarterly observations of several external and internal indicators between 2000-2013. The external variables included foreign real output and foreign nominal interest rates, while the internal factors consisted of capital flows, real exports, real output, the inflation rate, nominal interest rate, and nominal exchange rate. Considering the policy responses in the model for portfolio investment alone, the impulse response function (IRF) of this model indicated that a substantial increase in capital inflows is followed by a rise in real output and the inflation rate, which reached the maximum level in the first year. Moreover, as expected, together with the economic expansion, the nominal exchange rate (Rupiah) also appreciated against the US dollar over the short-run.

At the individual country level, in addition to Indonesia, related studies with comparable objectives and methodologies have previously been conducted on among others Australia and Malaysia. Following the macroeconomic model construction in Australia by Dungey and Pagan (2000), Raghavan et al. (2014) applied a comparable SVAR framework using the small open economy assumption to examine how shocks to capital flows relate to credit and the other main macroeconomic variables in Australia. Three blocks of variables are set up in the model, namely the foreign block, capital flows block and domestic block. While

several indicators like commodity prices, US GDP, the US Federal funds rate are accommodated in the foreign block, there is only one type of flow; portfolio investment, which is included in the capital flows block. In the next estimation, this flow is disaggregated further into direct and portfolio investment debt flows, and equity flows using a similar net values approach as with the aggregate flows. Also, more variables are introduced into the domestic block, which consists of GNE, GDP, inflation, cash rate, domestic private sector credit and the exchange rate. Using quarterly observations between 1989-2013, the estimation results suggested a significant positive response of domestic activity, as well as an appreciation of the exchange rate. When disaggregating the flows, only debt flows delivered a substantial influence on the economy, markedly on the GNE, GDP and credit. Thus, in Australia, compared to equity flows, the debt flows are more important to the economy.

Using a similar approach, Hwa et al. (2017) also incorporated some global and domestic variables into the SVAR model, consisting of a world production index, global liquidity, VIX, an industrial production index, CPI, the short-term interbank interest rate, nominal effective exchange rate, credit, equity prices and portfolio flows. This research aimed to evaluate the causes of the portfolio flows and their impact on the Malaysian economy during 2000-2015. Related to the second objective, the study found a significant effect from higher portfolio inflows producing and appreciation of the exchange rate, and likewise, with the higher equity prices, more credit, and short-term growth.

3.2.2. Policies Related to Capital Flows in Indonesia

The most valuable lessons learned from the global financial crisis have concentrated on the importance of strengthening the domestic economy, as well as maintaining the financial system's stability. During these hard times, the emerging economies had to deal with the challenges from the global shocks, whilst having shallow domestic capital markets. A policy mix was generally applied to mitigate the negative impacts, without sacrificing economic growth. According to the IRC Task Force-ECB (2016), there have been policy changes along with economic transition in some major advanced economies post the global financial crisis. The loosened monetary policy and quantitative easing (QE) programmes applied in these countries have encouraged higher volatility in the global financial markets. As a consequence, with large swings in cross-border capital flows between economies, calling for a higher awareness from the worldwide policy makers. In the situation of high and volatile capital inflows into emerging economies, Kawai and Takagi (2010)

highlighted three main risks: the macroeconomic risk, financial stability risk, and capital flow reversal risk. The macroeconomic risk is explained further by the acceleration of credit growth, the appreciation of the exchange rate, and the rise of inflation. The financial stability risk can be associated with increasing asset prices, the maturity and currency mismatch, and the lower quality of assets. Capital flow reversals can bring significant risk to the international reserves, as well as severe currency depreciation, which can endanger the domestic economy.

Indonesia is one of the countries which has adopted the Inflation Targeting framework (IT) to achieve domestic price stability. Introduced since 2003, it has only been fully implemented since mid-2005. However, taking into account the lessons learned from the global financial crisis, since 2010, the existing policy framework has been enlarged, covering both price and financial system stability (Warjiyo, 2016). In addition to the conventional monetary policy which solely rely on the interest rate, the policy mix also incorporates macroprudential policies through the macro-financial linkages in the financial system and capital flows. The key message is that integration is important to assess the procyclicality of the financial system and the build-up of systemic risks. Four main elements comprise the policy mix, they are the interest rate and exchange rate policy, macroprudential policy, and capital flow management.

a. Interest rate and exchange rate policy

According to Warjiyo (2014), the setting of the policy mix in Indonesia has recently become more challenging, as there is a need for balancing the dilemma between the stability of the macroeconomic and financial system. In order to achieve this stability, monetary policy is focused on the setting of the optimum interest rate, with the support of flexible exchange rates and optimal capital flow management. The short-term priority of the policy mix has been directed to macroeconomic stability over economic growth, leaving the latter as a medium-term objective.

Under this framework, the interest rate policy should be supportive of the inflation target set by the central bank. At the same time, it is also essential to manage movements in the exchange rate. The exchange rate policy in Indonesia is aimed at keeping the Rupiah's value in line with its fundamentals. Since 1997, Indonesia has applied a floating exchange rate system, allowing for flexibility in the Rupiah's value against the US dollar as the primary reference. In this system, the exchange rate policy could also serve as a buffer to external shocks. Although the Rupiah exchange rate is mostly settled through the market

mechanism, in some cases, the central bank could decide to intervene in the market. Reformation of Indonesia's exchange rate system has taken place several times since the first fixed exchange rate system in August 1971 to November 1978, and then this system was changed to a managed floating exchange rate system with widened intervention bands, that was applied from November 1978 to August 1997. Just before the crisis in 1997, the intervention bands were widened from Rp192 (8%) to Rp304 (12%) (Simorangkir, 2006). A higher flexibility in the exchange rate system has now been accommodated in the floating exchange rate system since then.

Maintaining exchange rate stability is very important for most emerging countries, remarkably during the massive capital inflows episode post the financial crisis, as the financial markets are typically still underdeveloped, while the surge of inflows was dominated by short-term funds which were more volatile. Combining both interest rate and exchange rate policies, a reliable monetary policy is expected to be more feasible to achieve.

b. Macroprudential policy

Macroprudential policy has been recently developed to safeguard the domestic financial system's stability, in addition to strengthening the effectiveness of monetary policy. This policy is essential to tackle the procyclicality and build-up of systemic risks in the financial system by focusing on the prudential measures. Related to capital flows, Kaminsky et al. (2005) described the flows cyclical characteristics. The capital flows are considered as procyclical if a positive correlation between the cyclical components of net capital inflows and output exists. In these circumstances, the economy borrows from abroad in the good times, and lends/repays during the bad times.

Furthermore, IMF-FSB-BIS (2016) explained the systemic risk exists in two elements: the vulnerabilities in the time dimensions, and the vulnerabilities in the cross-sectional or structural dimensions. While the first corresponds to the build-up of risks over time, the latter relates to the risk distribution within the financial system at any point in time. The Committee on the Global Financial System (CGFS) articulated two main objectives of macroprudential policy: (i) to improve the resilience of the financial system during economic downturns, and (ii) prevent an excessive build-up of financial risks, which tend to be procyclical in the boom and bust of the financial cycles (BIS, 2010). Furthermore, macroprudential policy is expected to complement the microprudential program which has been focused on the safety and soundness of individual institutions.

The Basel Committee on Banking Supervision on the BIS (2015) stated that both monetary and macroprudential policy can reinforce each other in moderating the economic cycles and promoting a more resilient system. The macroprudential policy objective in terms of strengthening the financial system's resilience can support monetary policy by protecting the domestic economy from severe financial disturbances. Similarly, when the stability of the macroeconomy has been achieved, the financial system becomes less vulnerable to further procyclicality risks. According to Warjiyo (2017), the experience of implementing macroprudential policy in Indonesia has been considered as being effective, not only in mitigating the build-up of systemic risks, but also in strengthening monetary policy, and therefore, both objectives in maintaining financial and price stability can be achieved.

As reported by the Committee on the Global Financial System (CGFS) (BIS, 2010), macroprudential policy has been adopted by a large number of emerging countries, yet some of the instruments have been implemented before 2010. In Indonesia, macroprudential instruments adopted include: (i) Limits on Loan to Value (LTV) and Financing to Value (FTV) for mortgage lending; (ii) Limits on Down Payment (DP) for automotive loans; (iii) Loan to Funding Ratio (LFR) linked Reserve Requirements; (iv) Countercyclical Capital Buffer (CCB).

Introduced in 2012, both the Loan to Value (LTV) and Financing to Value (FTV) have similar objectives in controlling the excessive credit growth in mortgage lending and preventing an extreme increase in house prices, although the first instrument is applied to commercial banks, and the latter is intended for the sharia-based banks. The limit of these instruments is determined and adjusted based on the purpose of either tightening or easing the monetary policy. The current LTV/FTV is set at 85%-90% for the first mortgage lending facility and continues to decrease to 80%-90% and 75%-85% for the second and the third facility respectively.

Since 2012, a macroprudential instrument for the automotive sector through a limit on Down Payments (DP) for an automotive loan is also applied to the commercial and sharia-based banks and the finance companies. Like the LTV/FTV, this instrument is intended to curb the excessive credit growth in the automotive segment by setting the minimum down payment to 20%, 25% for vehicles with two and three or more wheels respectively, and another 20% for the vehicle used in productive sectors.

The Loan to Funding Ratio (LFR) is linked to the Reserve Requirement (RR) regulation for the banking sector in order to promote credit intermediation and to deepen domestic

financial markets as well as to expand the source of funding for the banks. Overall, this instrument is expected to encourage domestic economic growth. The current LFR linked to RR is set at 78%-92%.

Following the Basel Committee on Banking Supervision recommendation, a Countercyclical Capital Buffer (CCB) has been implemented for commercial and sharia-based banks in Indonesia since 2016. The BIS (2010a) mentioned that the objective of this instrument is to protect the banking sector from excessive credit growth which has often been connected to the build-up of systemic risk. The banks are required to accumulate the buffer of capital during the upturn time so that it can be used in the downturn period. Currently, this CCB is set at 0% in Indonesia, subject to regular evaluations every six months.

c. Capital Flow Management

The implementation of the policy on capital flow management is intended to alleviate procyclicality and the build-up of systemic risks from external debt, as well as from capital flow volatility. Some types of capital flows, like banking flows and portfolio flows are relatively more volatile and short-term than FDI flows, thus, become an easy target for speculators. This increasing volatility of capital flows has been one of the recent challenges faced by many emerging economies, including Indonesia.

Some of the capital flow management instruments applied in Indonesia include (i) the minimum holding period of the central bank bill, (ii) limitation on short-term off-shore borrowing for banks, (iii) financial market deepening. In addition, new regulations on risk management for the non-bank corporate external debt were implemented in 2014. As an example, when the authorities intend to absorb excess liquidity in the money market during times of large capital inflows, the minimum holding period of the central bank bill was extended. In 2010 for instance, the holding period was set to be a minimum of six-months. At the same time, the short-term off-shore borrowing allowed for banks was up to 30% of the bank's capital. The financial market deepening was encouraged by introducing the JISDOR (Jakarta Interbank Spot Dollar Rate) in the foreign exchange market, as well as by developing the repo market. However, after the taper tantrum by the Fed in 2013, the policy was loosened. The investors could hold the central bank bill for a minimum of only one-month. Furthermore, off-shore borrowing was also adjusted by including more transactions that could be excluded in this borrowing type.

Capital flow management in a period of a surge in capital inflows or outflows sometimes needs to be applied in parallel with other policies. As has been widely documented, despite the benefits, the surge in capital inflows can potentially bring a threat to the stability of the domestic financial and macroeconomic condition. The vulnerability can be observed for example from the strong exchange rate appreciation in a relatively short period, asset price bubbles, and rapid credit expansion. When the economy is overheating, the policy of interest rate adjustment solely will no longer be effective. If the interest rate is pushed higher in this period (especially when inflation is low and stable), it will encourage even higher short-term capital inflows (Warjiyo, 2017). In this case, the policy maker can apply foreign exchange intervention to stabilize the exchange rate (from appreciating excessively), as well as raising the reserve requirements to absorb excess liquidity in the domestic money markets. This policy combination can also be applied for the opposite condition, in the case of capital reversal.

3.3. Data and Measurement

3.3.1. Data

This chapter covers a long time period of observations for Indonesia and the US, comprising 27 years (108 quarters) from 1990q1 until 2016q4. However, this length of time has not been possible with Japan, since the data are available from 1996q1 until 2016q4. Therefore, only 21 years (84 quarters) are gathered for Japan.

As described earlier, the objective in this research will be accomplished using two approaches, the single and two-country SVAR models. Both approaches assume Indonesia is a small open economy. In the single country approach, the influence of the rest of the world on the Indonesia's domestic macroeconomy is taken into account in the estimation. This model requires some global data such as world output, global interest rate, and global commodity prices. In the two-country approach, the role of US and Japan are accommodated in the models. This approach also allows us to capture the spillover effect from a shock to the foreign capital flows to Indonesia's economy. Specifically, it includes the effects on domestic capital flows and exchange rates.

The main data sources are the International Financial Statistics, Balance of Payment (BOP), FRED (Federal Reserve Bank of St. Louis), Bank for International Settlements (BIS) and the Organization for Economic Cooperation and Development (OECD), as listed in Table 3-3. To obtain capital flows variable in the percentage of GDP, the original capital flows

data (in rolling 4-quarter sum) is divided by the current price GDP (at an annual level) for each country. For some variables like GDP, export, exchange rates, credit and commodity price, the data are expressed in the growth rate (%) terms. Next, the moving average method is applied to fill the missing data in some observations. With one of the capital flow variables chosen in each model, 10 dimensional matrices are analysed.

Later on in the estimation, this chapter utilizes the original data instead of the detrended series as has been used in the previous works such as in Dungey and Pagan (2000), Raghavan et al (2014), and Jayasuriya and Leu (2017), since we want to capture the original dynamics of the data rather than focusing on the cyclical measurement alone.

Table 3-3. List of Variables and Data Sources

Variable	Variable Name			Unit	Source
	Indonesia	US	Japan		
Capital Flows					
Aggregate Capital Flows	ICF	UCF	JCF	% of GDP	BOP
Direct & Portfolio Investment Flows	IDP	UDP	JDP	% of GDP	BOP
Other Investment Flows	IOI	UOI	JOI	% of GDP	BOP
Domestic Variables					
Real GDP Growth	IGDP	UGDP	JGDP	%	OECD
Inflation	IINF	UINF	JINF	%	IFS
Nominal Exchange Rates Growth	IER	-	JER	%	FRED (Federal Reserve Bank of St. Louis)
Credit to Private Non-Financial Sector Growth	ICRE	-	-	%	BIS
Export Growth	IEX	-	-	%	IFS
Domestic Money Market Interest Rates	IINT	UINT	JINT	%	IFS
Global Variables					
Global Commodity Price Growth	ICP	-	-	%	Datastream, based on OECD
Global Money Market Interest Rates	MRATE	-	-	%	IFS
World Output Growth	WGDP	-	-	%	OECD

3.3.2. Variables

The summary statistics of the three countries data are presented in appendices in Table A3-1 and Table A3-2. Note that the number of observations depend on the data availability in

each country. In this case, Japan has more limited observations (1996q1-2016q4) compared to Indonesia and US (1990q1-2016q4).

There has been much discussion on choosing between the net and gross approach in the capital flows studies. According to Ahmed Zlate (2014), the selection between gross and net flows depends on the objective of the study. If the focus is to examine an exchange rate appreciation or overheating problem, the netflows approach is a better option. Alternatively, the gross flows are commonly used in observing for example the association between the flows and the impact of capital controls, unconventional monetary policy alongside financial stability concerns. In addition, Gregorio (2013) pointed out that preference between the two approaches can be determined based on the risks and potential impacts. When a study intends to find the relationship between the flows with the financial system's vulnerability, a gross flows approach is more suitable, while a net approach can be applied to analysis of the exchange rates and competitiveness.

Despite of those different argumentations, the selection of capital flows approach in this paper is based on the objective of the study. In line with the existing literatures focusing on the relationship between capital flows and economic performances (i.e Jayasuriya and Leu (2017), Raghavan et al. (2014), Cardarelli et al. (2010), Reinhart and Reinhart (2009)), this study adopts net flows approach instead of using gross flows, considering the main interest in analysing the impact of net capital flows on the domestic macroeconomic condition.

Before continuing with the model estimation, a structural break test is performed in order to verify whether the data had substantially changed around the crisis periods, particularly during the 1998 Asian financial crisis and the 2008 global financial crisis. To accommodate the crisis periods, dummy variables are included in the initial estimation. In this case, variable d98 and d08 that represent the structural breaks are incorporated into the regressions. The values of d98 and d08 are set equal to 1 since the beginning of the corresponding year (1998q1 and 2008q1 respectively) onwards, and 0 otherwise. However, since accommodating these dummies does not suggest significantly different results, the estimations will be focused on the original model.

Referring to the sources of the data, the measurement of the variables accommodated in the estimations are described as follows:

a. Capital Flows

The Balance of Payments and International Investment Position Manual (BPM6) (IMF, 2009) classifies the international accounts into 5 functional categories of investment: direct investment, portfolio investment, other investment, financial derivatives (other than reserves) and employee stock options, and reserve assets. In line with most of the discussion in the existing literature, this study will be focused on three types of investments, the direct investment, portfolio investment, and other investment. The sum of those three components is also included to estimate the aggregate flows. Considering their different characteristics, this chapter also explores which types of flow matters more for the domestic economy. Thus, in the next estimation, this study examines the disaggregated data, where other investment is separated from direct and portfolio investment data. In all estimations, the netflows approach is applied by subtracting the outflows from the inflows in each flow category.

b. GDP Growth

This variable refers to the growth of real Gross Domestic Product based on the 2010 reference year, which has been seasonally adjusted. The quarterly GDP data is gathered mainly from the OECD website both for the individual countries and world GDP[12]. In the last decade, the share of GDP from OECD countries has been stable on above 60% of the world GDP[13].

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[12] Due to the data availability for the aggregate real GDP in quarterly basis, the world GDP in this study refers to the GDP as in the OECD total. The aggregation covers the GDP in 36 members of OECD countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

[13] To get a big picture of the share of this data, I compared the annual data of world GDP taken from the World Bank database to the total GDP in OECD countries available in the OECD database. The OECD GDP share was around 63-69% during 2007-2016.

c. Inflation rate

The Inflation data in this study refers to the inflation rate at the end of the period, thus, it is connected to the end of each quarter during the observation periods.

d. Export Growth

Based on the IMF data, all export values are stated as Free on Board (f.o.b). We take the growth of these values for use in the estimation. Taking this variable into account in the models is particularly important as Indonesia is one of the commodity exporter countries.

e. Exchange Rate Growth

In this study, the exchange rate variable is expressed as the growth in nominal terms. According to the IFS, the nominal terms here refers to the period average national currency per US dollar. Therefore, a decrease in exchange rate values indicates a nominal appreciation.

f. Credit Growth

Credit to the private non-financial sector according to the BIS is the total outstanding credit provided by domestic banks, all economic sectors and non-residents at the end of each quarter. Included in the definition of the private non-financial sector are the non-financial corporations, households and the non-profit institutions. The non-financial corporation's data is disaggregated further into the private and public-owned corporations. Moreover, the credit instruments include loans, as well as debt securities. In this study, the credit variable used in the estimation is stated in a growth form.

g. Money Market Interest Rates

The definition of money market interest rates compiled by the IFS are not exactly similar, however still comparable between countries. For Indonesia data, it represents the rate of one-day loans among the commercial banks. While in US, this rate implies the weighted average rate based on the money lent by banks through New York brokers. In Japan, the term of the money market interest rate has been changed since July 1985. Before this period, it refers to the lending rate for collateral and unconditional loans, and afterwards it is related to the lending rate for collateral and overnight loans in the Tokyo call money market. In the single-country SVAR, we also include the global money market interest rate that is calculated based on the average of the rates in 3 major advanced economies, namely the US, UK, and Japan.

h. Commodity Prices Growth

   As explained by the OECD, the global commodity price is the price of the world primary commodities, except for energy. The data is seasonally adjusted and using 2010 as the reference year. In the estimation, the commodity prices are expressed in a growth form.

In all of the SVAR models, the variables are divided into three blocks, namely the capital flows block, domestic block and global block. The net flows approach which has been widely chosen in the literature is applied in this chapter. As in the IMF database, the net flows are calculated based on capital inflows minus the outflows. In addition to the aggregate values, the net flows are also disaggregated into direct and portfolio investment flows and other investment flows, to find out whether the impacts are different between the two types of flows.

3.4. Methodology

3.4.1. Theoretical Framework: Single and Two Country SVAR

Villaverde and Ramirez (2010), defined the structural VAR's as "*a multivariate, linear representation of a vector of observables on its own lags and (possibly) other variables as a trend or a constant*". Since it was discussed by Sims (1980), the SVAR model has become very popular in economic research. The SVAR model has been generally applied to the research focusing among others on understanding the aggregate economic fluctuations, such as the business cycle fluctuations, clarifying the dynamics of unexpected economic shocks, and explaining the impact of economic policies.

The popularity of this method cannot be separated from the advantages offered, as discussed for example by Villaverde and Ramirez (2010), Gottschalk (2001), and McCoy (1997). In summary, the SVAR is a straightforward model, thus, easy to estimate. The SVAR also offers greater flexibility through the restrictions imposed on the system of equations, based on the combination of economic theory and time series data. These restrictions can be applied as contemporaneous or to the long-run, depending on the assumptions of the underlying shocks, which can be considered as temporary or permanent.

Despite these advantages, several criticisms to this method have also been raised. One drawback is related to the output of the SVAR which are sensitive to the identification restrictions imposed on the model, thus, it is very dependent on the initial assumptions. In

many studies, the analysis is trying to find reasonable answers from the model that can be associated with the conventional wisdom. In addition, there is a potential bias in the estimation results which is possibly due to omitted variables that are not considered in the model. In other words, if those variables have a strong correlation with the involved variables, the estimated economic shocks obtained can be unreliable. Furthermore, the SVAR typically works with restricted dimensional matrices, due to the orthogonality of the underlying shocks (Gottschalk, 2001).

As is commonly known, the SVAR is the extension of the traditional VAR which has been widely used over several decades. This model is the structural form of the reduced form VAR. With similar capabilities as the VAR framework, the SVAR model offers more flexibility by combining economic theory with the time series data, with the theory incorporated through the restrictions on the contemporaneous correlations. The main objective typically is associated with the analysis of the dynamic response of the economic variables tested to numerous disturbances. A Structural VAR model can be written as:

$$B_0 Y_t = B_1 Y_{t-1} + \cdots + B_p Y_{t-p} + \varepsilon_t \quad (3.1)$$

where:

Y_t = a vector of endogenous variables at time t, with dimension of (Kx1)

B_i = a matrix of parameters for 0,1,2,…,p, with dimension of (KxK)

ε_t = a vector of uncorrelated orthogonal structural shocks at time t, with dimension of (Kx1)

We assume that $E(\varepsilon_t \, \varepsilon_t') = Z$, where Z is the variance-covariance matrix of ε_t.

The reduced-form model can be obtained by pre-multiplying both sides in equation (3.1) by B_0^{-1}:

$$Y_t = \underbrace{B_0^{-1}B_1}_{A_1} Y_{t-1} + \cdots + \underbrace{B_0^{-1}B_p}_{A_p} Y_{t-p} + \underbrace{B_0^{-1}\varepsilon_t}_{u_t} \quad (3.2)$$

Hence, the reduced form vector autoregression of p-th order (VAR(p)) with repressed intercept term can be noted as:

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + u_t \quad (3.3)$$

where:

Y_t = a vector of endogenous variables at time t, with dimension of (Kx1)

X_t = a vector of exogenous variables at time t, with dimension of (Kx1)

p,q = number of lags of endogenous and exogenous variables

$A_1 = B_0^{-1}B_i$ from the structural form VAR in equation (3.2)

u_t = a vector of disturbances

Here we can notice that there is a relationship between the structural and reduced form residuals as in $\varepsilon_t = B_0 u_t$. The reduced-form error covariance matrix is E($u_t\ u_t'$)=Σ. This is consistent with E($B_0 u_t u_t' B_0'$)=Z, which denotes the variance-covariance matrix of the errors in the structural form VAR.

The estimation of the SVAR model involves two steps, the unstructured first stage or reduced form VAR, followed by the structural form of the VAR. These steps ensure the consistent estimates of ε_t, as well as the parameter estimates of $B_0, B_1, \ldots B_p$. In the SVAR estimation, the elements above the diagonal are set to zero, in contrast with the ones below the diagonal that represent the structural disturbances. Furthermore, each equation in the SVAR system has an assigned dependent variable, consequently, the diagonal elements in the matrix are set to 1. One of the key aspects in estimating the SVAR model is imposing the restrictions on the B_0 and Z matrices (here matrix B_0 represents the instantaneous relations among the model's variables). Therefore, an exactly or over-identified matrix is required.

A. Single-Country SVAR Model

To explore how international influences via net capital flows may affect a number of major macroeconomic indicators in Indonesia, this study applies the Structural Vector Autoregressive (SVAR) model. A vector autoregressive model has been widely applied in macroeconomic modelling, particularly under closed economy assumptions. This study follows the SVAR model developed in the existing literature, among others by Dungey and Fry (2000) and Dungey and Pagan (2000). Under the small and open economies assumption in the model, the main restriction is the existence of block exogeneity between economies, where Indonesia is taking part as the small open economy and the rest of the world is the large open economy.

One of the benefits of this model is that it is able to present the effects of various shocks on the variables of interest to the economy, based on the outputs from impulse response functions (IRF). In addition, this model can be adjusted to the current economic condition as it allows for more flexibility. Therefore, theory and historical data or stylized facts can be accommodated within the model's construction through the imposed restrictions and certain assumptions.

To differentiate with other approaches used in this study, we refer the first model as the single-country SVAR model, since it is constructed based on Indonesia's economic condition and influenced by several global representative variables. Whilst for the latter one, instead of including the world variables, the model will be focused on the influences of another country, which is involved in major trading activities with Indonesia.

B. Two-Country SVAR Model

The two-country SVAR model in this study incorporates one other country in the model in addition to Indonesia, which is the main area of interest. The selected country is determined based on the size of trading transactions with Indonesia. Given the data of Indonesia's largest trading partner in 2016, this study accommodates the US and Japan's influences in the SVAR model. Limited research has so far been done in this area, particularly with the focus on the impact of international capital flows on the Indonesia's economy using this methodology. Most of the studies are mainly emphasizing on the construction of a general macroeconomic model, without considering the capital flows influence.

3.4.2. Model Specification and Identification Restrictions

In line with the forgoing studies on macroeconomic modelling which applied the SVAR methodology, some assumptions from this approach are also be adopted in this research. Following Dungey and Pagan (2000), the model is specified based on the assumption of block exogeneity, where Indonesia is considered as a small open economy. Under this assumption, the external factors are allowed to influence the domestic economy, but not the other way around. This assumption will be applied in both the analysis of the single and two-country SVAR approach. Applying the block exogeneity assumption above, only global variables can influence the Indonesia's economy, thus, there is no feedback impact from the Indonesia's economy that can go internationally.

Furthermore, in this study we also intend to see how different the results are when the capital flows components are disaggregated into direct and portfolio investment flows and other investment flows. This disaggregation according to several studies is important to see which types of capital flows are more crucial for the domestic economy and policy considerations.

A. Single-Country SVAR Model

As mentioned earlier, the basic concept of the single-country SVAR model in this study is mainly in line with Dungey and Pagan (2000), who built an SVAR model for the Australian

economy. With the addition of capital flows into the model, although the focus of the study is different, the model is almost comparable with Raghavan et al (2014) and Jayasuriya and Leu (2017). Raghavan et al (2014) was focusing on investigating the connection between portfolio flows and credit and how they affect the Australian economy, while Jayasuriya and Leu (2017) constructed an SVAR model of the Indonesia's economy by incorporating the cross-border capital and financial flows with more attention to monetary policy. Additionally, in the case of Indonesia, this study differs from Jayasuriya and Leu (2017) in the extension of the SVAR, by applying the two-country SVAR, which will be discussed in the next section.

Focusing on the short-term impact of a shock on capital flows to several domestic macroeconomic indicators, we determine the contemporaneous structure of the SVAR models for each scenario. Several restrictions are imposed on the contemporaneous matrix, based on theory, historical data/stylised facts and previous studies. Thus, we expect to get estimation results which are consistent with economic theory and intuition. Due to the foreign block exogeneity assumptions, we set groups of variables, principally as a global and domestic block. Next, the capital flows variable as the main area of interest is set as a stand-alone block. Under this scenario, the variables are categorized as follows:

$$X_t = \left[X_{1,t}\ X_{2,t}\ X_{3,t}\right]$$

where $X_{1,t}\ X_{2,t}$ and $X_{3,t}$ represent the global block, capital flows block and domestic block respectively.

$$X_{1,t} = [ICP_t\ WGDP_t\ MRATE_t]$$

$$X_{2,t} = [ICF_t]$$

$$X_{3,t} = [IEX_t\ \ IGDP_t\ IINF_t\ IINT_t\ ICRE_t\ IER_t]$$

The capital flows block covers 3 type of flows which will be analysed individually using the net values concept, namely the total capital flows, direct & portfolio investment flows, and other investment flows.

As a small open economy, Indonesia is assumed to be substantially affected by the dynamics of international economic development. On the contrary, the Indonesia's economy has no impact on the global economic condition. Thus, the comparatively small size of Indonesia’s economy is accommodated in the model by restricting any feedback impacts on the global economy. Referring to the block categories, this means that the global

block may affect the capital flows block and domestic block, while there is no feedback effect from both blocks on the global block. Additionally, this study is limited the analysis to the short-term impacts, reflected by the contemporaneous effect of the system. Table 3-4 below describes the contemporaneous structure of Indonesia's SVAR model. As a consequences of the foreign block exogeneity assumption, all components above the diagonal in the matrix are set to zero. Therefore, only the points below the diagonal are estimated, with several exceptions. The missing points in the matrix below represent these exemptions, where the coefficients are set to be zero. Furthermore, as the main interest is to analyse the impact of the shocks on capital flows to the Indonesia's economy, all domestic equations with the connection to the capital flows variable will be estimated, aside from the export equation.

Table 3-4. Contemporaneous Structure of Indonesia SVAR Model

	CP	WGDP	MRATE	CF	IEX	IGDP	IINF	IINT	ICRE	IER
CP	*									
WGDP	*	*								
MRATE	*	*	*							
ICF	*	*	*	*						
IEX	*	*			*					
IGDP	*	*		*	*	*				
IINF	*			*		*	*			
IINT	*		*	*		*	*	*		
ICRE	*	*		*	*	*	*	*	*	
IER	*	*	*	*	*	*	*	*	*	*

Notes: * denotes the coefficients that are not restricted to zero.

The order of the variables in the matrix is set to be consistent with the assumptions of the model, as well as with the existing literatures on the Indonesia's SVAR economic model (i.e Simorangkir (2006), Jayasuriya and Leu (2017)). The sequence for the analysis is, the global block, followed by the capital flows block and domestic block. Within the global block, the international commodity price (ICP) is considered as the most exogenous variable and placed before the world GDP (WGDP) and the money market interest rate (MRATE). Under this order, a shock to ICP is expected to contemporaneously impact both WGDP and MRATE, while WGDP is assumed to affect MRATE.

Following this group is the capital flows block (ICF). Positioned before other variables in the domestic block, this variable is treated as a more exogenous than other variables in the domestic block. As a consequence, ICF is assumed to react contemporaneously to the international influences, however, it is not responsive to changes in domestic variables.

Given this sequence, in the estimation of the capital flows equation, ICF is set as an exogenous variable and other variables in the domestic block are determined as endogenous. This is particularly relevant with regard to the IMF report (2017), related to discussions on the main drivers of capital inflows into Indonesia. In the report, the IMF suggested that those inflows have been significantly influenced by global factors. The global risk aversion, growth rate and interest rate differences between Indonesia and the US are indicated as the most influential indicators. With this sequence in mind, capital flows can have an immediate impact on the domestic variables, but not vice versa.

Given the assumptions applied in Indonesia's SVAR model, several exceptions are imposed in the matrix system. The first one is that the world GDP is prevented from having a contemporaneous impact on the interest rate and domestic inflation. Any pressure in global output is generally transmitted through the domestic activity, thus, requiring some lags before it affects domestic inflation and interest rates. The assumptions imposed on the world GDP system in this study is consistent with Dungey and Pagan (2000), Dungey and Fry (2000), Raghavan et al. (2014), and Jayasuriya and Leu (2017).

Furthermore, following Raghavan et al. (2014) and Jayasuriya and Leu (2017), the second exemption is applied to the global money market interest rates, which are assumed not to have an immediate impact on domestic exports, GDP, inflation, and credit. This implies that these variables are not expected to react immediately to changes in the international interest rate. Apart from this exception, the international interest rate is assumed to quickly influence Indonesia's capital flows, interest rate, and exchange rate. The variable MRATE, as discussed earlier, is determined by the average money market interest in three major advanced economies, the US, UK, and Japan. The IMF (2017) has clearly provided several historical instances on how changes in US interest rates since the global financial crisis for example, have affected capital inflow and outflow dynamics and interest rate adjustment in emerging countries, including Indonesia. In addition, Mohanty (2014) discussed the interest rate channel as a spillover effect from advanced to emerging economies. This channel suggests the possibility of policy rate adjustments in emerging economies in a similar direction to advanced economies. For example, decreasing interest rates in advanced economies may be followed by the same policy in emerging economies in order to avoid a further deterioration in the trade competitiveness, as a consequence of an exchange rate appreciation. Moreover, Mohanty (2014) has also emphasized the importance of the exchange rate as the main transmission channel for movements in international interest rates in open economies. An increase in the international interest rate

for example, can lead to an appreciation in the domestic exchange rate, given the existence of a floating exchange rate system in the domestic country.

Other than on the IEXP variable, there are no more exemptions placed on capital flow restrictions contemporaneously, indicating this variable is adjusting slowly to changes in capital flows. In other words, applying this arrangement in the equation will allow me to analyse the immediate influence of capital flows on all other domestic variables, which is the main focus of this study.

The last exception in the contemporaneous system is for exports, where it is restricted to not having an impact on domestic inflation and interest rate. However, exports are allowed to respond to international commodity prices and the world output. Known as a commodity exporter, Indonesia's export performance is highly influenced by the price of global commodities and foreign demand. Warjiyo (2012) provided an example of how Indonesia has benefited from high commodity prices after the global financial crisis up to mid-2011, where the country had a surplus in its balance of payments, as measured by the current and capital account. The exception imposed in this export system is particularly in line with Jayasuriya and Leu (2017) who constructed equations in a single-country SVAR model for Indonesia.

In addition, we consider the Taylor rule in determining the contemporaneous matrix system, as in Dungey and Pagan (2000), Dungey. et al (2014), and Raghavan (2014). The nominal interest rate is assumed to be responsive to the changes in inflation and output. A typical monetary policy has been implemented by Indonesia's central bank and is expected to guide the interest rate in the money market, reflecting a strong correlation between both rates in this study.

B. Two-Country SVAR Model

The second approach used to answer the research objectives in this chapter is the two-country SVAR model. The fundamental idea has been adopted from Dungey and Fry (2000), which analysed the international influences on the Australian economy. By including three countries in the model, they expanded the traditional VAR model to a multi-country SVAR. However, the capital flow variable was not accommodated in their model, leaving this as one of the challenges in this study.

In a similar way, the role of two other countries is explored in this study by allowing the influence of the US and Japan into Indonesia's SVAR model. Under this approach, two-

country SVAR models are constructed for the Indonesia-US and Indonesia-Japan relationships. By incorporating both economies as international influences we expect to determine the effects of including two dominant world economic players in the model. The variables categorized for each country are as follows:

$Y_t = [Y_{1,t}\ Y_{2,t}\ \ Y_{3,t}]$

where $Y_{1,t}$, $Y_{2,t}$ and $Y_{3,t}$ represent the US, Japan and Indonesia block respectively.

$Y_{1,t} = [UCF_t\ USGDP_{,t}\ UINF_t\ UINT_t]$, corresponding to US capital flows, GDP, the inflation rate, and money market interest rate

$Y_{2,t} = [JCF_t\ JGDP_t\ JINF_t\ JINT_t\ JER_t]$, corresponding to Japan's capital flows, GDP, the inflation rate, money market interest rate, and exchange rate.

$Y_{3,t} = [ICF_t\ IGDP_t\ IINF_t\ IINT_t\ IER_t]$, corresponding to Indonesia's capital flows, GDP, the inflation rate, and money market interest rate, and exchange rate.

In addition to the Indonesia-US SVAR variables, a commodity price (CP) variable is added into the model. The existing literature such as by Fratzscher (2012) and Reinhart and Reinhart (2009) have recommended the use of commodity prices, among other push factors, in driving capital inflows in some economies. In Indonesia particularly, taking into account the commodity price is essential, since it is considered as a commodity exporter country.

a) The SVAR Model for US-Indonesia

In this model, the US economy acts as the anchor of the system, making it block exogenous to the Indonesia's economy. As a consequence, Indonesia's economy is assumed to be significantly influenced by the US economy, but not conversely. Thus, there is no feedback form the Indonesia's economy to the US economy. For this reason, the variables in the US block are placed before the Indonesian block. The restrictions imposed for the Indonesia-US SVAR model are presented in Table 3-5.

In the exception of capital flows equation, the restrictions set in the contemporaneous matrix structure is mostly in line with the multi-country SVAR by Dungey and Fry (2000) and Jayasuriya and Leu (2017). Furthermore, it also consistent with the single-country SVAR model as discussed in the previous section.

Table 3-5. Contemporaneous Structure of Indonesia-US SVAR Model

Variable		US				Indonesia				
	CP	UCF	UGDP	UINF	UIR	ICF	IGDP	IINF	IIR	IER
CP	*									
UCF	*	*								
UGDP	*	*	*							
UINF	*	*	*	*						
UIR	*	*	*	*	*					
ICF	*	*	*		*	*				
IGDP	*		*			*	*			
IINF	*			*		*	*	*		
IIR	*				*	*	*	*	*	
IER	*	*	*	*	*	*	*	*	*	*

Notes: * denotes the coefficients that are not restricted to zero.

b) The SVAR Model for Indonesia-Japan

Applying similar restrictions as in Indonesia-US SVAR model, the contemporaneous structure of the Indonesia-Japan model is depicted in Table 3-6.

Table 3-6. Contemporaneous Structure of Indonesia-Japan SVAR Model

Variable		Japan					Indonesia				
	CP	JCF	JGDP	JINF	JIR	JER	ICF	IGDP	IINF	IIR	IER
CP	*										
JCF	*	*									
JGDP	*	*	*								
JINF	*	*	*	*							
JIR	*	*	*	*	*						
JER	*	*	*	*	*	*					
ICF	*	*	*		*		*				
IGDP	*		*				*	*			
IINF	*			*			*	*	*		
IIR	*				*		*	*	*	*	
IER	*	*	*	*	*	*	*	*	*	*	*

Notes: * denotes the coefficients that are not restricted to zero.

3.4.3. Unit Root Test

To check for the stationarity of the data, a unit root test using the Augmented Dickey-Fuller (Dickey and Fuller, 1979; Hamilton, 1994) is performed. Becketti (2013) explained several examples on how to conduct the test. Assume that the true model can be written as:

$$y_t = \alpha + y_{t-1} + u_t \tag{3.4}$$

The Dickey-Fuller test fits the model below:

$$y_t = \alpha + \rho y_{t-1} + \delta_t + u_t \tag{3.5}$$

where y_t is the variable; α is the constant term; u_t is an independently and identically distributed zero-mean error term; and δ_t is the time trend term.

Setting $\alpha = 0$ or $\delta = 0$ may lead to a regression that is likely to be afflicted by the serial correlation problem. Therefore, the augmented Dickey-Fuller test controls for this issue by fitting a model as in the equation below:

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta_t + \lambda_1 \Delta y_{t-1} + \lambda_2 \Delta y_{t-2} + \cdots + \lambda_k \Delta y_{t-k} + \epsilon_t \tag{3.6}$$

where k is the number of lags specified in the test; and β, λ_1, λ_2, λ_k is the parameter estimates of y_{t-1}, Δy_{t-1}, Δy_{t-2}, Δy_{t-k} respectively. The null hypothesis for the ADF unit root test in equation (3.6) is that $\beta = 0$, which indicates that the series contains a unit root. Therefore, a rejection of the null hypothesis suggests that y_t follows a stationary process.

Following this procedure, we include a trend term in the test to account for the trend stationarity. The optimum number of lags chosen for the tests is as previously determined using the Akaike Information Criterion (AIC). The unit root test results presented in Table 3-7 indicate that for the longer observation periods (1990q1-2016q4), most variables are stationary. Some indicators that are not stationary, such as some of the capital flows variables and credit growth are transformed into first-differenced form before the estimation. Similar data transformation is also performed for the non-stationary indicators in shorter observation periods in Table 3-8.

Table 3-7. Unit Root Test Results Based on Augmented Dickey-Fuller (ADF), 1990q1 – 2016q4

Variable	Lags	MacKinnon approximate P-value for Z(t)	Stationarity
INDONESIA (1990Q1-2016Q4)			
Indonesia Direct & Portfolio Investment Flows (% of GDP)	2	0.179	No
Indonesia Other Investment Flows (% of GDP)	1	0.275	No
Indonesia Aggregate Investment Flows (% of GDP)	2	0.191	No
Indonesia Interest Rates (%)	3	0.011	Yes
Indonesia Inflation (%)	4	0.056	Yes
Indonesia GDP Growth (%)	2	0.006	Yes
Indonesia Export Growth (%)	3	0.000	Yes
Indonesia Exchange Rates Growth (%)	3	0.000	Yes
Indonesia Credit Growth (%)	4	0.115	No
US (1990Q1-2016Q4)			
US Direct & Portfolio Investment Flows (% of GDP)	2	0.247	No
US Other Investment Flows (% of GDP)	3	0.002	Yes
US Aggregate Investment Flows (% of GDP)	2	0.500	No
US Interest Rates (%)	2	0.005	Yes
US Inflation (%)	2	0.000	Yes
US GDP Growth (%)	3	0.004	Yes
GLOBAL (1990Q1-2016Q4)			
Global Interest Rate (%)	2	0.001	Yes
World GDP Growth (%)	2	0.001	Yes
Commodity Price Growth (%)	2	0.002	Yes

Notes: H0: the variable contains a unit root, Ha: the variable was generated by a stationary process; a trend term is included to account for the trend stationarity; the optimum lags are determined based on Akaike information.

Table 3-8. Unit Root Test Results Based on Augmented Dickey-Fuller (ADF), 1996q1 – 2016q4

Variable	Lags	MacKinnon approximate P-value for Z(t)	Stationarity
INDONESIA (1996Q1-2016Q4)			
Indonesia Direct & Portfolio Investment Flows (% of GDP)	2	0.015	Yes
Indonesia Other Investment Flows (% of GDP)	1	0.194	No
Indonesia Aggregate Investment Flows (% of GDP)	2	0.013	Yes
Indonesia Interest Rates (%)	3	0.002	Yes
Indonesia Inflation (%)	4	0.019	Yes
Indonesia GDP Growth (%)	2	0.001	Yes
Indonesia Exchange Rates Growth (%)	3	0.002	Yes
JAPAN (1996Q1-2016Q4)			
Japan Direct & Portfolio Investment Flows (% of GDP)	4	0.468	No
Japan Other Investment Flows (% of GDP)	4	0.174	No
Japan Aggregate Investment Flows (% of GDP)	3	0.055	Yes
Japan Interest Rates (%)	2	0.299	No
Japan Inflation (%)	4	0.206	No
Japan GDP Growth (%)	3	0.000	Yes
Japan Exchange Rates Growth (%)	3	0.026	Yes

Notes: H0: the variable contains a unit root, Ha: the variable was generated by a stationary process; a trend term is included to account for the trend stationarity; the optimum lags are determined based on Akaike information.

3.5. Estimation Results

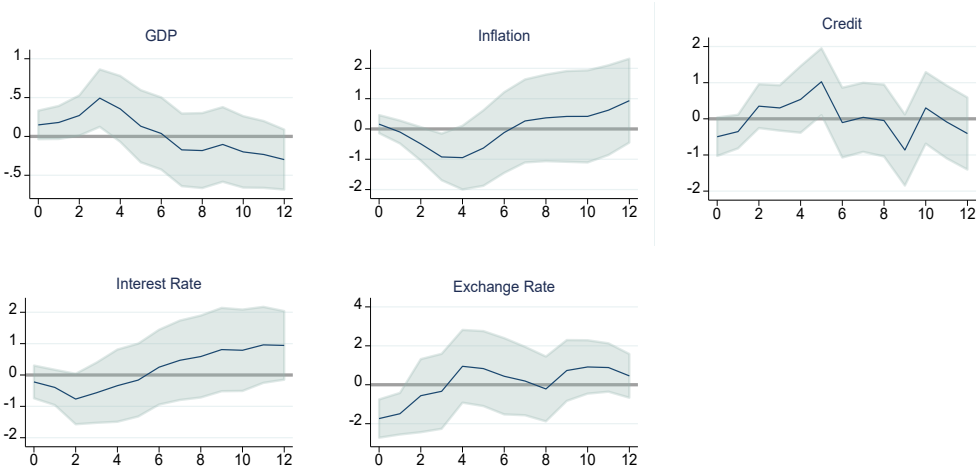
This section discusses the estimation results based on the impulse response functions from the single and two-country SVAR models. As explained earlier, this study focuses on three major components of capital flows: direct investment, portfolio investment, and other investment. The aggregate capital flow is calculated by summing those elements. For the disaggregation, the flows are classified into two categories by separating other investment from the total flows.

3.5.1. Single Country – Small Open Economy

A. Aggregate Investment Flows

The estimation outcomes from the contemporaneous structure of the model allow us to analyse the short and medium-term effects of the shocks on capital flows to the Indonesia's economy. The impulse response functions (IRF) of each variable are displayed in Figure 3-7, while the estimated coefficients are presented in Table A3-3 in the appendices. Since the off-diagonal components in the A matrix comprise the negative values of actual contemporaneous effects, the estimated coefficients are interpreted on the opposite sign. Moreover, the result from the joint significance tests (for the underlying VAR of the SVAR models) in Table A3-6 indicates that we can reject the null hypothesis of the coefficients on all the lags for all the other endogenous variables being jointly zero for a particular equation, as the probability>χ^2 is less than 0.05.

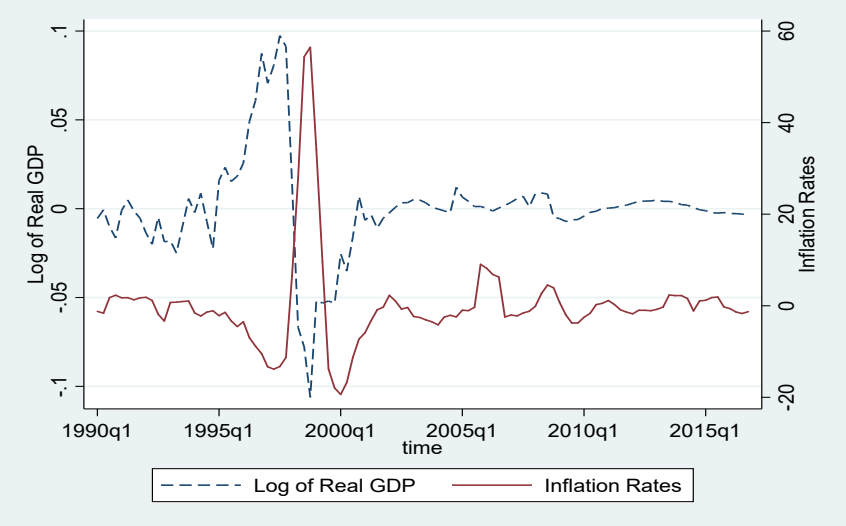
Figure 3-7. Indonesia SVAR Model: The Impact of a Total Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4



As expected, the IRF graph above shows that a shock to the aggregate capital flows is followed by an expansion in the economy, as represented by the positive and increasing pattern of GDP growth in the short-term. Nevertheless, the response goes back to zero after three quarters, leading to a non-significant estimated parameter overall. Furthermore, we also notice that the shock is responded to by domestic inflation, although it requires several lags before rising. From the estimation results in Table A3-3 we can see that inflation increases by 1.70% on impact after a capital flows shock. For Indonesia, this finding is not surprising, as it reflects the pattern of the GDP and inflation historical data presented in Figure 3-8, where the GDP has been constantly leading the inflation rates in the last three

decades. How capital inflows can have an impact on inflation in Indonesia was also discussed by Titiheruw and Atje (2008). The inflation rates have showed an upward trend in the event of large foreign capital inflows.

Figure 3-8. Indonesia's GDP and Inflation Rate, 1990q1 to 2016q4



Notes: The GDP series is expressed in the log format.
Both the GDP and inflation rate series are smoothed by HP filters.

Source: International Financial Statistics (IFS), author calculations.

The shock to capital flows in this model also produces a response by the domestic money market. Although the interest rate declines contemporaneously, it is shortly bouncing back after 2 quarters of lags. A higher interest rate is typically more attractive for the investors, which in turn, may attract more financial flows. This reaction is common also in other emerging economies, suggesting that the country is still focusing on attracting more funding from foreign investors. However, the estimated coefficient of the interest rate indicates that this response is not strong enough to be statistically significant.

Furthermore, a substantial response is also shown by the credit growth indicator. The IRF graph demonstrates a temporary falling amount of credit to the private sector when the shock occurred. Although the response shows some increasing patterns, the negative reaction appears to be more dominant, resulting to a negative estimated parameter that is statistically significant. This result is not very surprising, particularly when the country has a concern for inflation. As discussed by Ostry et al. (2010), the increasing domestic money supply as a result of high capital inflows might generally be sterilized via open-market operations or typically a corresponding decrease in domestic credit. In addition, the

literature has suggested the association of capital flows with credit booms are commonly focusing on the banking flows, which is part of other investment. For example, IMF (2018) implied that a rise in domestic credit is linked to a substantial increase in other investment flows. In this estimation, the response of aggregate investment is strongly influenced by the direct and portfolio investment, which has been the main component of Indonesia's capital flows.

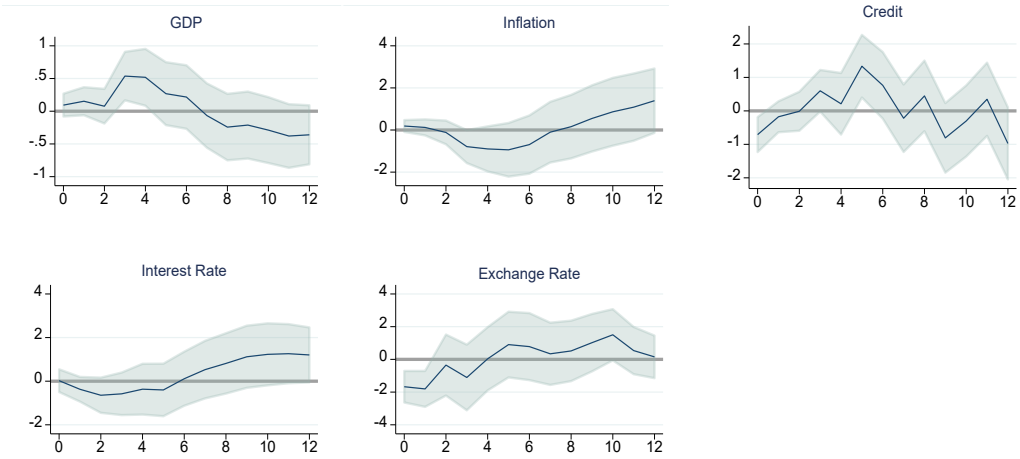
In respect to the exchange rates, as expected, the Rupiah is appreciating immediately against the US dollar. The estimated coefficient of this variable indicates that holding all other shocks constant, the exchange rate appreciates contemporaneously to a one standard deviation shock on capital flows by 6.07%. A previous work by Titiheruw and Atje (2008) on how capital inflows may impact Indonesian economy after the economic crisis in 1997 suggested that the rupiah appreciated by approximately 6% since net capital inflows were detected in 2002. Lastly, among all domestic indicators, the response of export growth is not particularly discussed in this study. This is due to the restriction imposed on the coefficient, as we assume that there is no contemporaneous impact from capital flows shock to exports.

B. Direct and Portfolio Investment Flows

In order to understand the impact of the shock from different types of capital flows, this section discusses the reaction of the domestic economy when the shock is applied to direct and portfolio investment flows. The estimation result in Figure 3-9 shows that this type of flow has the strongest link to aggregate investment. As in the aggregate flows model, the positive sign of the GDP growth parameter indicates a domestic economic expansion reaction after the flows shock, although it is very short-lived. The relationship between economic growth and direct investment flows in particular have been discussed in the literature among others by Bosworth and Collins (1999). They suggested that direct investment has an important role in promoting economic growth, assuming the investment are engaged with the productive sectors. In Indonesia, based on the recent sectoral data in 2015 (Figure 3-6), direct investment has been placed into productive sectors such as: (i) the agriculture, hunting and forestry with a 24% share; (ii) manufacturing with a 22% share; and (iii) mining and quarrying sector with a 18% share. Therefore, the finding with regard to the GDP acceleration is reasonable, although from the estimation results, we already know that the response is not very strong.

Moreover, as with the aggregate level, other variables like inflation and exchange rates also respond significantly to the direct and portfolio investment flows shock. These substantial responses in this model are in line with our expectation, as they have become more dominant in Indonesia's capital flow composition (see Figure 3-3 in the previous section). In addition, as in the aggregate flow estimation, the parameter estimate of the credit indicator is negative. This outcome is in line with the previous work by Blanchard et al. (2016) who suggested that DI flows have a negative impact on credit growth, and that this effect depends on the extent to which DI substitutes for domestic intermediation. Moreover, they also found that although portfolio flows have a positive relationship with credit growth, the effect is relatively weak.

Figure 3-9. Indonesia SVAR Model: The Impact of a Direct & Portfolio Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4

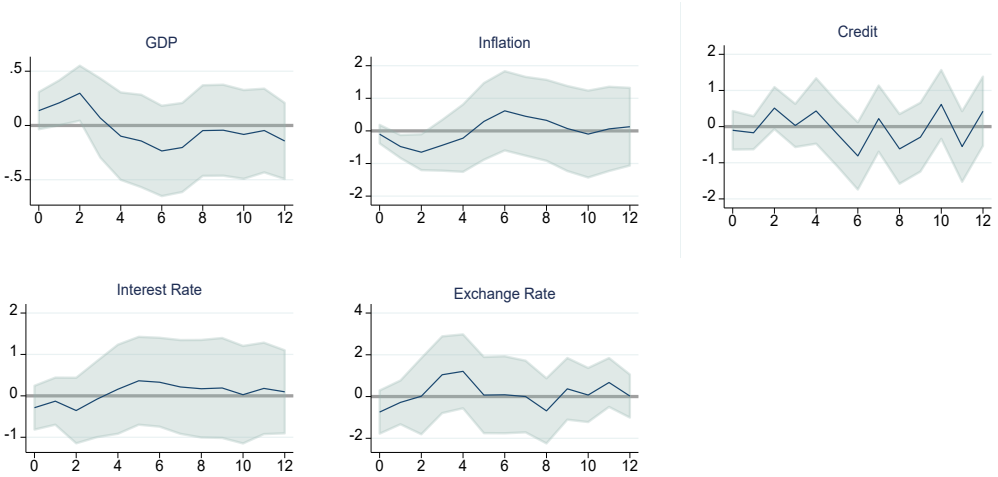


C. Other Investment Flows

This section specifically explores whether the domestic economy reacts to the shock on other investment flows. As discussed earlier, the disaggregation of other investment from the rest of the flows is mainly due to its different characteristic. As suggested by the European Central Bank (ECB, 2016), this flow is typically more volatile compared to other types of flows. Although the IMF (2009) classifies other investment as a residual category in the balance of payments, these flows cover important flow components such as capital flows into bank accounts or provided as loans, currency and deposits, insurance, pension, and trade credits. Furthermore, López Mejía (1999) discussed the importance of other investment over the periods 1970s-1980s, which represented the debt flows, specifically

bank lending. This flow was the most important component of private net capital flows during that periods, before replaced by direct and portfolio investment in the 1990s.

Figure 3-10. Indonesia SVAR Model: The Impact of an Other Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4



The IRF graph in Figure 3-10 indicates that apart from the GDP growth which shows a very short-lived impact after other investment shocks, there are no clear responses from other domestic indicators. As in the previous estimation results from direct and portfolio investment flows, the response of GDP expansion does not last for a very long period after the shock, resulting with an insignificant reaction in total. Overall, the unsubstantial response of the domestic economy to this specific type of flow shock is not very surprising in the case of Indonesia, at least for two possible reasons: the relatively small share of this flow compared to the other two flows and its volatile characteristic. The historical data of other investment flows in Indonesia as presented in Figure 3-2 and Figure 3-3 shows that its amount and share (to the aggregate flows) has dropped significantly in recent years. Compared to the period before the Asian financial crisis in 1998-1999, the values, as well as the share of other investment to aggregate investment in the current period has been noticeably lower. In addition, the volatile characteristic of this flow has previously increased compared to others by the ECB (2016) that highlighted the high volatility of the flow prior to and during the global financial crisis. The banking flows are one of the components of capital flows that has shown the most volatile pattern during these periods.

3.5.2. Two Country Approach

This section presents the estimation results from both of the two-country SVAR models, the Indonesia-US and Indonesia-Japan model. Using this approach, we can explore whether Indonesia's economic indicators respond contemporaneously to two types of shocks originating from the foreign and domestic capital flows. We refer to the impact of the foreign flows shocks as the spillover effect in this study.

Considering the complication of the bigger matrix size, less domestic variables in the two-country SVAR model are incorporated. Therefore, in addition to the foreign indicators, only five domestic indicators are included in the model, consisting of capital flows, GDP growth, inflation, interest rates, and exchange rates. Moreover, as discussed in the literature (Sims, 1992) incorporating global commodity price variables in the model is common since it can influence all economies. Due to the availability of data in the two countries, more observations from 1990q1-2016q4 are used in the Indonesia-US model, while in the Indonesia-Japan model the data is more limited, starting from 1996q1-2016q4.

3.5.2.1. Indonesia – US

A. Total Investment Flows

Allowing for the US influences in the two-country SVAR model for the aggregate capital flows, the estimation results are presented in the IRF graphs below. The graphs describe the impacts of the shock from the US (Figure 3-11) and Indonesia's capital flows (Figure 3-12) to the Indonesia's economy respectively. As the consequence of the restrictions in the model, only impacts on Indonesia's exchange rates and domestic capital flows are presented when the foreign flows shock is applied. Focusing on the spillover effect after a shock to the US capital flows, we observe no obvious effect on Indonesia's exchange rates and domestic capital flows at the aggregate level. Nonetheless, there are some significant contemporaneous responses shown by domestic indicators after the shock on domestic flows. The estimated coefficients in Table A3-4 in the appendices implies that following the domestic capital flows shock, there is an increase in GDP growth, a rise in inflation and an appreciation in the Rupiah exchange rate against the US Dollar. Among all indicators, only the interest rate is not responding to this shock.

Based on the estimation results from aggregate flows we can conclude that while no noticeable impacts are delivered by the US capital flows shock, there are substantial effects from Indonesia's capital flows shock. The limited amount of the US's investment in

Indonesia (Figure 3-5) might be one of the possible explanations for this insignificant spillover effect. Nevertheless, some indirect impacts are noticeable once the US influence is taken into account in the model. Furthermore, the reaction of domestic indicators to domestic flow shocks presented Figure 3-12 shows a similar pattern as in the previous single-country SVAR, where the global influence is considered. In particular, we have noticed a consistent response from inflation and exchange rates. The important role of the US as one of the major world's economic players might have affecting this outcome.

Figure 3-11. Indonesia-US SVAR Model: The Impact of a US's Total Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4

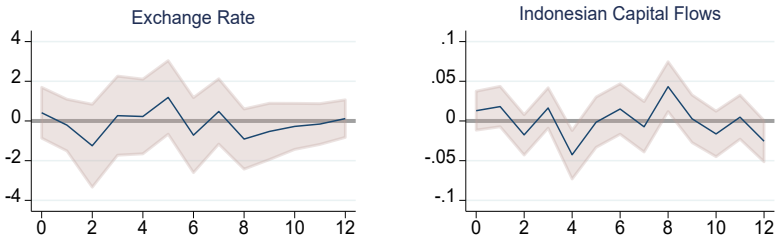
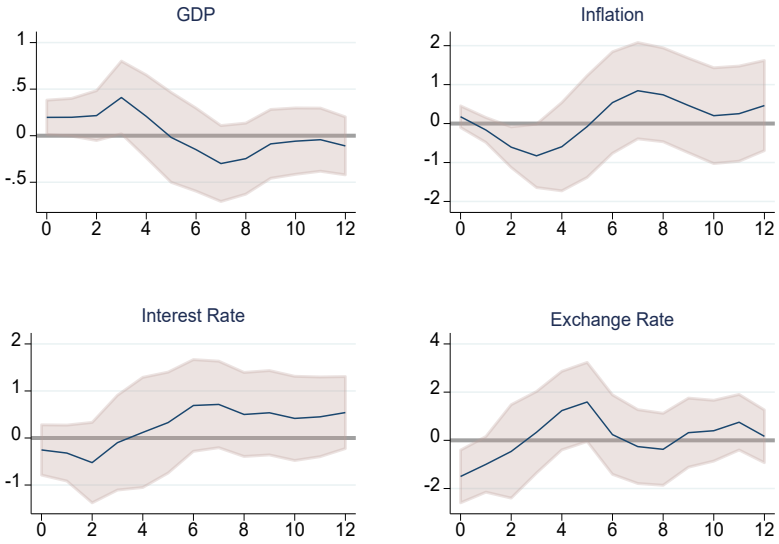


Figure 3-12. The Indonesia-US SVAR Model: The Impact of an Indonesia's Total Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4

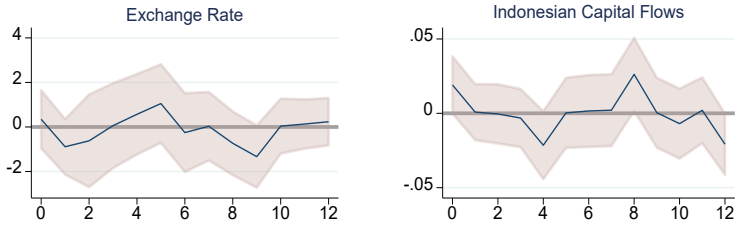


B. Direct and Portfolio Investment Flows

Figure 3-13 demonstrates the estimation results from direct and portfolio investment flows. The IRF graph below shows how domestic capital flows and exchange rates react to the foreign flows shock. In this case, we can notice a significant spillover effect from the shock

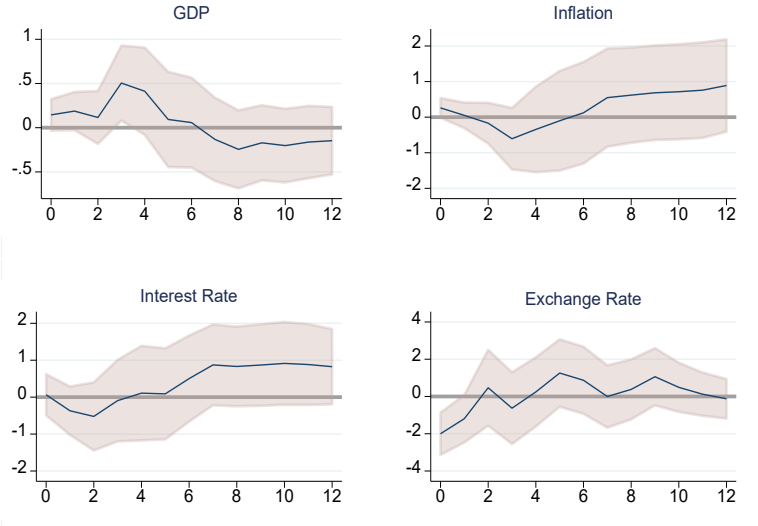
on both indicators. However, the magnitude of domestic flows coefficient of 0.05% can be considered very small. In addition, the Rupiah is contemporaneously appreciating against the US Dollar, although the impact is very short-lived. After 2 quarters, the exchange rate starts to depreciate, resulting in a positive response overall. Nevertheless, this reaction is not very strong, as the estimated coefficient is slightly above the 10% level of significance.

Figure 3-13. Indonesia-US SVAR Model: The Impact of a US's Direct and Portfolio Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4



Focusing on the domestic flows shock in Figure 3-14, Indonesia's economy responds to the direct and portfolio investment shock in almost a similar way to the aggregate flows shock, suggesting a close link between the two flows.

Figure 3-14. Indonesia-US SVAR Model: The Impact of an Indonesia's Direct & Portfolio Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4



The estimated coefficients indicate that three out of four domestic variables are statistically significant in responding to the shock. The GDP growth is increasing, and inflation is rising on impact after the shock, being statistically significant at the 5% level. In addition, the Rupiah exchange rate is strongly appreciating at 1% level of significance. As in the

aggregate flows estimation, it is interesting to find that the interest rate indicator never responds contemporaneously to the shock.

C. Other Investment Flows

Unlike the estimation results from the direct and portfolio investment flows, the shock on other investment flows appears to have no important impact on Indonesia's economy. Although the shock on the US other investment flows is followed immediately by an appreciation in the Rupiah exchange rate, the impact is very short-lived that the estimated parameter becomes not statistically significant. Similarly, from the IRF graph in Figure 3-15 we also observe that there is no spillover effect from this shock to the domestic capital flows.

Figure 3-15. Indonesia-US SVAR Model: The Impact of a US's Other Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4

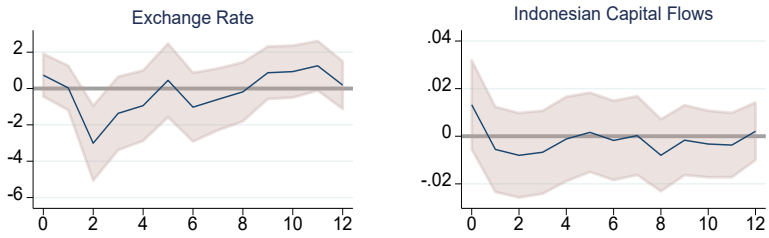
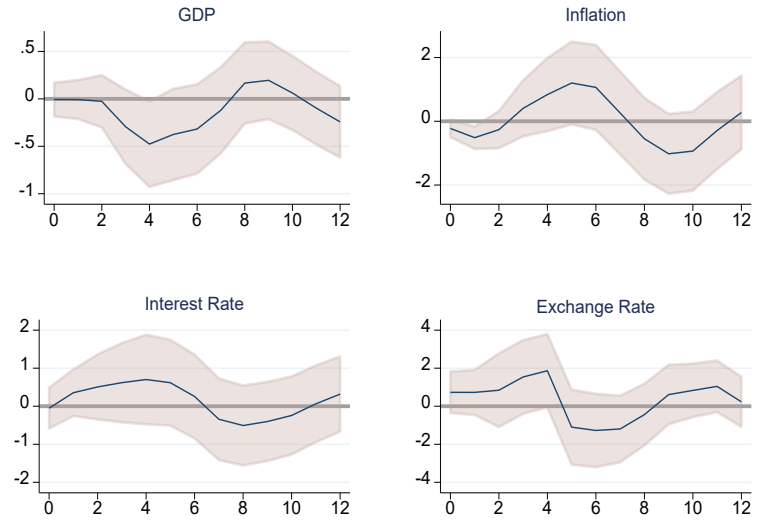


Figure 3-16. Indonesia-US SVAR Model: The Impact of an Indonesia's Other Investment Flows Shock to Indonesia's Economy, 1990q1 to 2016q4



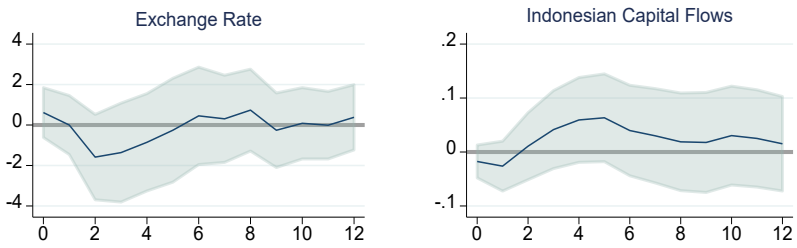
Next, focusing on the domestic shock depicted in Figure 3-16, only the exchange rate variable shows a short-lived depreciation after the shock. Nevertheless, this impact is relatively weak, being statistically significant at the 10% level. Other than this indicator, there is no other significant response from the economy in this Indonesia-US SVAR model. As described earlier, the relatively small share of other investment to total capital flows in Indonesia is one of the possible explanations for the insignificant finding. Overall, the finding from the domestic response in this section is in line with the previous estimation in the single-country SVAR model for similar types of flows.

3.5.2.2. Indonesia – Japan

A. Total Investment Flows

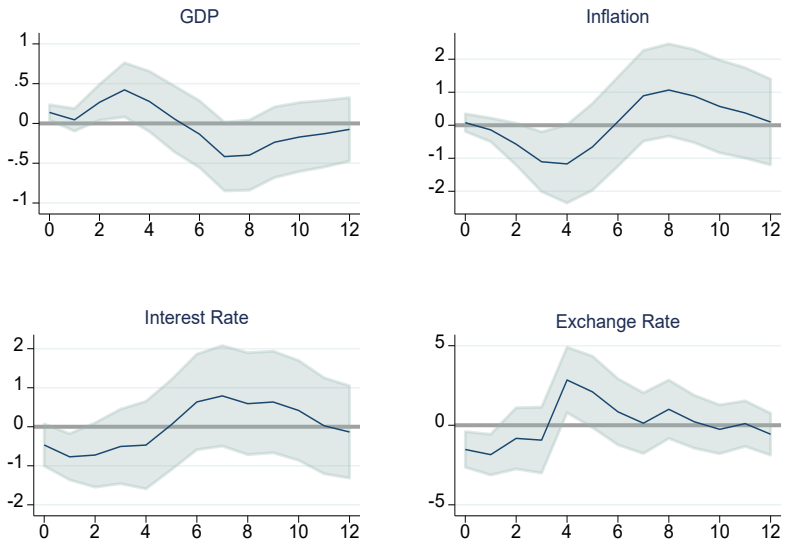
This section presents the findings from Indonesia-Japan SVAR model. The estimated coefficients are presented in Table A3-5 in the appendices. In aggregate level, there is no strong spillover effect following the shock to Japan's capital flows. Both exchange rates and domestic capital flows show insignificant contemporaneous reactions. The response of Rupiah exchange rates emerged in Figure 3-17 only shows a transitory appreciation pattern in the initial periods before going back to zero. It is also the case for the domestic flows, where the increasing path only appears in the early periods and close to zero afterwards.

Figure 3-17. Indonesia-Japan SVAR Model: The Impact of a Japan's Total Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4



Under the same model, different outcomes are found when the shock is applied to domestic flows (Figure 3-18). In this case, the estimated coefficient of GDP growth is positive, indicating an increasing domestic economic activity, while the estimated parameter of the exchange rate is negative, suggesting a contemporaneous appreciation response after the shock. The reaction of both indicators can be considered as a strong response, as they are statistically significant at the 1% level. By contrast, inflation and interest rates do not respond substantially to this shock in the short-term, as none of their coefficients are statistically significant.

Figure 3-18. Indonesia-Japan SVAR Model: The Impact of an Indonesia's Total Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4



B. Direct and Portfolio Investment Flows

In this direct and portfolio flows estimation, the shock on Japan's capital flows is responded to by an immediate domestic capital flows expansion, as reflected in Figure 3-19. One of the possible explanations is related to the significant share of Japan's investment in Indonesia. Based on the 2015 direct investment data (Figure 3-5), Japan is the second major investor with a relatively large share of investment in Indonesia after Singapore, accounting for 24% of the total investment originated from Asian countries. On the opposite, exchange rate indicator in this model does not react significantly to the shock.

Figure 3-19. Indonesia-Japan SVAR Model: The Impact of a Japan's Direct & Portfolio Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4

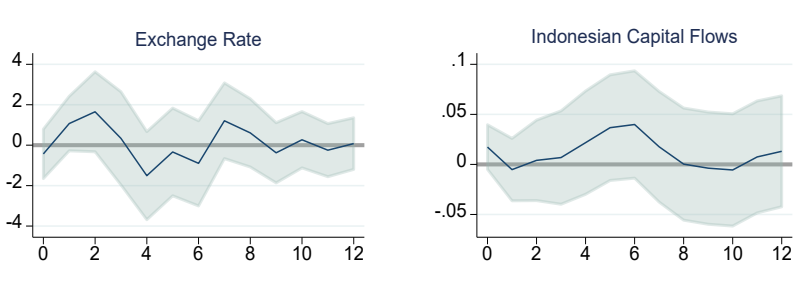
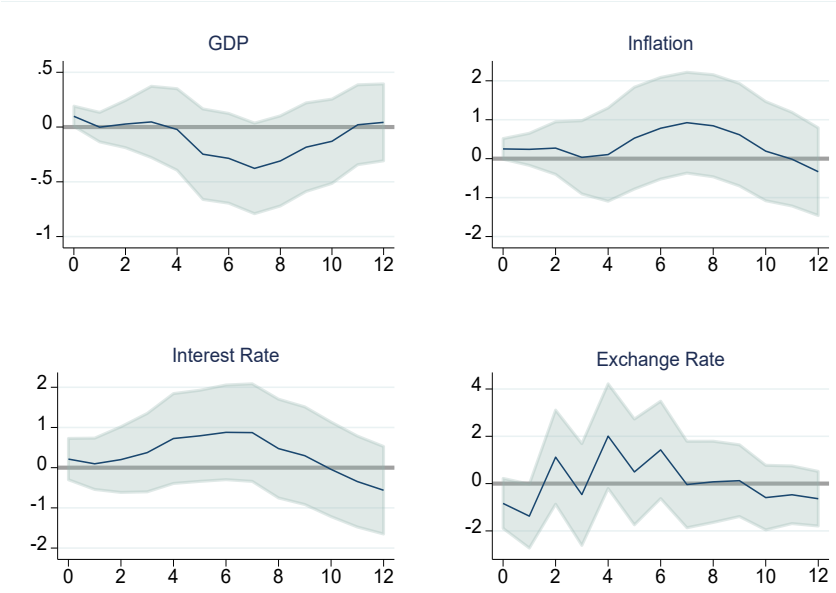


Figure 3-20. Indonesia-Japan SVAR Model: The Impact of an Indonesia's Direct & Portfolio Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4



From the domestic flows shock impact presented in Figure 3-20, only the response of the exchange rate is statistically significant in the short-term. In this case, the Rupiah currency is appreciating against the US Dollar. Although from the IRF graph we notice several substantial reactions of other domestic indicators (when the responses are above or below zero), the overall impacts are not statistically significant (see Table A3-5). This finding is in line with previous estimation result from the aggregate flows, suggesting the important role of this flow on the overall outcomes.

C. **Other Investment Flows**

Finally, this section discusses how a shock on other investment flows may affect Indonesian economy in the Indonesia-Japan SVAR model.

Figure 3-21. Indonesia-Japan SVAR Model: The Impact of a Japan's Other Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4

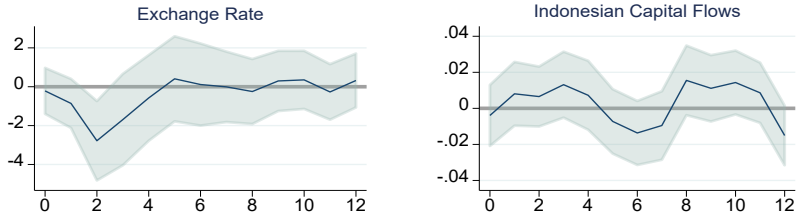
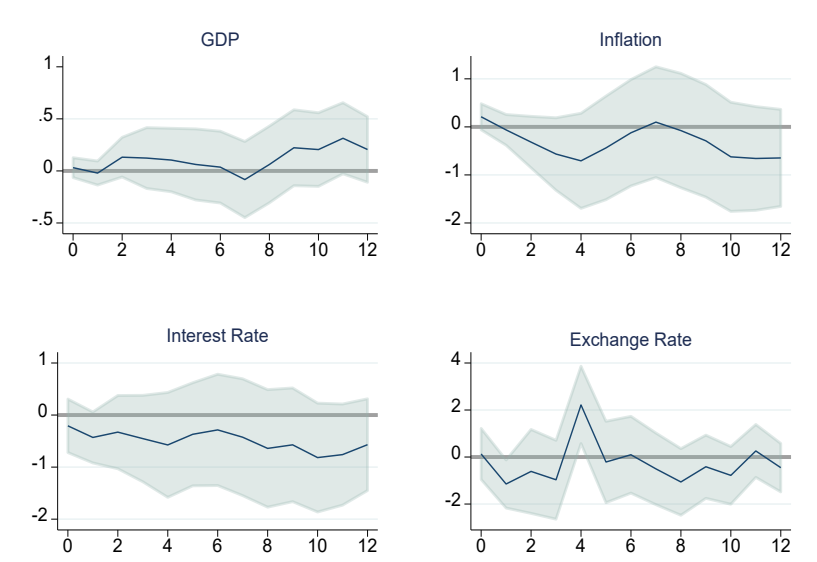


Figure 3-22. Indonesia-Japan SVAR Model: The Impact of an Indonesia's Other Investment Flows Shock to Indonesia's Economy, 1996q1 to 2016q4



Although we can perceive a contemporaneous appreciation on the Rupiah exchange rate, it is only lasting a very short time before going back to zero, resulting to an insignificant response (Figure 3-21). By contrast, a shock on Japan's capital flows leads to a decline in Indonesia's capital flows. However, the magnitude is relatively small and being weakly significant at the 10% level. Furthermore, Figure 3-22 depicts the IRF graphs when focusing on the impact of a shock on domestic capital flows. Here only inflation indicator that shows a statistically significant response at the 5% level. The estimated coefficient is positive, suggesting that inflation rate is increasing on impact after the shock.

Based on all estimations performed in this chapter, a short summary of the findings are: (i) comparing the outcomes between the two-country SVAR models, Indonesia's economy is more reactive to domestic capital flows shocks in the Indonesia-US model compared to in Indonesia-Japan model; (ii) apart from the findings in the other investment estimation, some major reactions of the economy can be seen from the exchange rate appreciation and the rise in inflation (although the latter variable is not statistically significant in the Indonesia-Japan model); (iii) the findings on major indicators in the two-country SVAR models are consistent with the ones from the single-country SVAR model. After all, one thing to bear in mind is, since the estimation results in the two-country SVAR models depend on the availability of the data in each country, a direct comparison will need to be done in a more precautious way.

3.6. Conclusion

Using quarterly observations from the last 27 years, this chapter explores how Indonesian economy responses to the shock on capital flows under the single and two-country SVAR approach. The latter approach is the main contribution of this study, as the current discussions in this area have been focusing on the single-country SVAR method. In constructing the models, this study modifies the multiple-country SVAR by Dungey and Fry (2000), by taking into account the influence of capital flows and concentrating the analysis on two countries.

While in the single-country SVAR, global factors are adopted, in the two-country SVAR, the influences are focused on some factors from the US and Japan as Indonesia's two main trading partners. Therefore, the latter approach allows us to examine the impact of foreign flow shocks (spillover effect) in addition to the effect of domestic flows shock. Some important findings based on the empirical results are as follows: first, in the Indonesia-US SVAR model, while no spillover effect is emerged from the US flows shock, a shock on domestic aggregate flows leads to a contemporaneous increase in GDP growth, a rise in inflation and exchange rates appreciation. Almost similar outcomes are obtained from estimation at disaggregate level, in particular from direct and portfolio investment flows. The only difference is the significant spillover effect from the US flows shock which leads to an increase in Indonesia's capital flows, although the magnitude is relatively small. As in the single-country SVAR model, no clear impact is found from the estimation of other investment flows.

Second, Indonesia's economy shows only limited responses to capital shocks in the Indonesia-Japan SVAR model. At the aggregate level, the shock on domestic flows is responded to by an increase in GDP growth and exchange rates appreciation. Once the flows are disaggregated, only the latter is statistically significant following the shock on the direct and portfolio investment flows. Moreover, in other investment flows estimation, the shock is only responded to by increasing inflation. Focusing on the spillover effect, we can only observe a significant impact on the increasing domestic capital flows, as no clear impact can be seen on the exchange rates.

Third, for a comparison, under the single-country SVAR framework, the estimation result on the aggregate level indicates that a shock on domestic capital flows is followed by an increase in inflation and an appreciation in the Rupiah exchange rates. However, responding to this shock, the credit growth is contemporaneously decreasing. This finding

is not surprising in a typical country with inflation concerns, as the resulting increase in domestic money supply can be sterilized via open-market operations, or generally a corresponding decrease in domestic credit. This outcome is similar with the direct and portfolio investment flows estimation. By contrast, no substantial responses of domestic indicators emerged from other investment flows estimation.

Fourth, in all SVAR models discussed above, the estimation results of the aggregate flows appear to be influenced more by the direct and portfolio investment flow shocks. This finding is not surprising as this type of flow has been the major component of capital flows in Indonesia.

Overall, we can summarize that: (i) under the single and two-country SVAR model, the Rupiah exchange rate has been consistently appreciating in responding to a domestic capital flows shock. This finding is confirmed for the aggregate flows, as well as for the direct and portfolio investment flows estimations; (ii) under the two-country SVAR model, focusing on the domestic flows shock impact, Indonesia's economy is more responsive to the shock in the Indonesia-US model and less responsive in the Indonesia-Japan model; (iii) while there is no clear spillover effect found at the aggregate level, some significant impacts are obtained from the disaggregate flows estimation, specifically from the direct and portfolio investment flows in both of two-country SVAR models, suggesting a noteworthy consequence of the disaggregation.

Statement of Authorship

This declaration concerns the article entitled:			
Do Capital Flows Matter for Monetary Policy Setting in Inflation Targeting Economies?			
Publication status (tick one) **Draft manuscript** [X] **Submitted** [ ] **In review** [ ] **Accepted** [ ] **Published** [ ]			
Publication details (reference)			
Copyright status (tick the appropriate statement) I hold the copyright for this material [ ] Copyright is retained by the publisher, but I have been given permission to replicate the material here [ ]			
Candidate's contribution to the paper (provide details, and also indicate as a percentage)	The candidate contributed to / considerably contributed to / predominantly executed the… Formulation of ideas: 100% Design of methodology: 100% ~~Experimental work:~~ Presentation of data in journal format: 100%		
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.		
Signed	Trinil Arimurti	**Date**	3 January 2020

Chapter 4. Do Capital Flows Matter for Monetary Policy Setting in Inflation Targeting Economies?

4.1. Introduction

Since being introduced by Taylor (1993), the Taylor rule has become a major factor for consideration by central banks when setting the interest rate reaction function. According to this rule, there is a simple linear relationship between the interest rate, inflation rate and the output gap. Originally, Taylor (1993) set a representative policy rule for the US economy based on the economic conditions at that time, by applying a certain weight to the price level and real output, even though there was no specific consensus established on the parameter size in the rule. This rule has now become a popular assessment approach for modelling the monetary policy stance of the central banks both in the advanced and emerging economies.

The standard version of the Taylor rule in Taylor (1993) was intended to be a general policy framework for central banks when assessing their interest rate decisions (Taylor, 2001). In reality, depending on the economic conditions, the central bank might need to do some adjustments or discretions to this normative guideline. As an example, since the early 2000s until the outbreak of the global financial crisis, the short-term policy rates in some advanced economies deviated substantially, when it was set to below what the rule suggested it should be (Taylor, 2007).

In recent years the literature on the rule has taken into account a wider set of information that is relevant to the current economic conditions. This version is known as the augmented version of the Taylor rule. Some important indicators like exchange rates, asset prices, risk and other financial variables have been considered to obtain the rule with the most satisfactory performance. The exploration on the role of exchange rates on the monetary transmission mechanism has been done by among others Obstfeld and Rogoff (1995), Taylor (2001), Coeure (2017), Froyen and Guender (2018), Aizenman et al. (2008), and Lubik and Schorfheide (2007). Whilst studies by Bernanke and Gertler (2000), Chadha et al. (2004), Morley and Wei (2012), Hafner and Lauwers (2015), and Wang et al. (2016) among others, have investigated the central banks' responses to asset price movements. A further extended rule which examines the relationship between the risk premium and other

financial variables with the interest rate setting has also occurred, for instance by Bekaert et al. (2013), Borio and Zhu (2012) and Caporale et al. (2018).

Taylor and Williams (2010) suggested that the exploration of alternative policy rules may need to involve the international linkages of monetary policy and economies. There are a limited number of studies discussing the influence of international linkages in the rule, particularly those that consider capital flow dynamics explicitly, although in the recent years, discussion on capital flows has drawn major attention from the policymakers. Most of the previous studies on the Taylor rule have been focused on the indirect relationship between the financial flows and monetary policy via exchange rate pass-through. This might due to the consideration of the volatile characteristic of the financial flows, that the policymakers become more prudent before deciding whether it is necessary to react directly to these changes.

Moreover, Taylor (2013a) indicated the need to consider a rule-based monetary policy, even though it serves as a general guideline for the policymakers. He implied that the recent phenomena of the increasing capital flow and exchange rate volatility have been closely related to changes in policy orientation in some major advanced economies, when the rules-based policy shifted to unconventional monetary policy.

The episodes of large cross-border capital flows between economies are inevitable when the global financial system is more integrated and capital more mobile. In particular, following two severe crises episodes in Asia around 1997/98 and the global financial crisis, which occurred in the advanced economies near 2008/09, there was a massive increase in capital mobility from advanced to emerging economies. Among several key drivers of this phenomenon, the policy interest rate setting in developed economies has been claimed as one of the most significant factors behind this movement (Ahmed and Zlate, 2014).

Even though these financial flows may offer some potential benefits, they can also trigger policy challenges for the receiving economies. This concern occurs especially when the size and volatility of the flows increases dramatically during a short time period and becomes larger than the size of the domestic economy. According to Sarno et al. (2016), massive capital inflows might cause some consequences for domestic asset prices (real estate price escalation), high inflation, and economic growth. Whilst a sudden stop is also risky, especially because it may trigger high interest rates, sharp depreciations and slower growth. In turn, it may affect the conduct of monetary policy and liquidity management becomes more complicated. In addition, Rey (2013) has described how large capital flow

movements may cause obstacles to effective macroeconomic management, and disturb monetary policy independence, even if the recipient country implements a flexible exchange rate policy. Therefore, the International Monetary Fund (2016) suggested a general approach to deal with the challenges and maintain financial stability by applying a policy mix, including macroeconomic policies, capital flow management measures, and macroprudential measures. Moreover, IMF (2018) advices the importance of managing risks from capital flows, where a prudential setting and adjustment of policy responses are required, particularly in the countries who experienced massive and volatile financial flows.

Given these challenges, a natural question to ask is, should the policymakers explicitly consider these financial flows in their policy rule? In other words, do the central banks need to be responsive to these capital movements? This study intends to provide empirical evidence on whether the central banks, in practice, are responsive to capital flow dynamics when setting their interest rate.

Taking the capital flows into the analysis of monetary policy, the empirical results suggest different findings for advanced and emerging markets. The advanced economies central banks seem to show more concern for capital outflows than inflows. Whilst in emerging economies, the policymakers are reactive to both capital outflows and inflows, indicating that the flow indicators are equally important to other variables examined in the policy rule models.

4.1.1. Research Objectives and Contributions

This chapter aims to capture the central bank reactions to capital flow dynamics by extending the existing Taylor rule in Taylor (2001) with the addition of the capital flows indicator. As most current studies have been focusing on the issues of the policy rule in relation to the exchange rate, asset prices, wealth indicators, interest rate spreads, and risk aversion in the financial market (e.g. Bernanke and Gertler (2000), Taylor (2001), Chadha et al. (2004), Aizenman et al. (2008), Bekaert et al. (2013), Wang et al. (2016) and Dağlaroğlu et al. (2018)), this study mainly contributes to the literature by exploring a potential alternative policy rule that consider the influence of capital flows explicitly in the policy objective. Moreover, this study also captures the behaviour of the policymakers during extreme periods of capital flows, as well as over normal periods, in order to see whether the central banks respond differently during both conditions. In this chapter, extreme capital flow episodes refer to the times when capital flow values are above the

upper and below the lower threshold bands. On the other hand, normal periods correspond to episodes when capital flows are within these threshold bands. To obtain a more comprehensive view on the role of capital flows from both sides, the foreign-owned (capital inflows) and the domestic-owned investment (capital outflows) are accommodated in separate estimations. Furthermore, following the literature, other indicators like the exchange rates and international variables, covering the fed funds rate and the VIX volatility index are included.

Relying on historical data, the analysis is extended by comparing the posterior inclusion probability (PIP) of each indicator considered in our policy rule. This probability is obtained using the Bayesian Model Averaging (BMA) estimations. The PIP contains a value that measures how likely a variable is to be included in the true model (Zeugner, 2012). The key point is to assess how important are capital flows, compared to other variables in the models.

Based on the motivations above, this chapter highlights some key questions such as should the central bank consider information about capital flow movements in their interest rate rule? When capital flows are considered as a relevant indicator in the policy rule, which type of flows matter the most? Do the central banks react similarly during extreme and normal capital flow episodes? Given the variety of types of rules in this study, which policy rule is more optimal to implement in emerging and advanced economies? Do the central banks' responses to selected variables in emerging economies differ from more advanced economies?

4.1.2. Outline of the Chapter

The chapter is structured as follows. Section 2 discusses the related empirical evidence regarding the application of Taylor rules in some countries. Section 3 describes the data and their measurement that are used in the estimation. Focusing on the Inflation Targeting countries, the observations covers 34 countries (10 advanced and 24 emerging economies). Next, Section 4 explains the methodology and the Taylor rule model specifications. Moreover, this section also discusses the Arellano Bond approach as the main estimator for our Taylor rule regressions. Following this section, the estimation results are discussed in Section 5. In addition to the standard baseline rule, the threshold Taylor rule is also estimated, by incorporating a lower and upper threshold band, using the 10^{th} and 90^{th} percentile. These thresholds correspond to the extreme episodes of capital flows (when the values are beyond those thresholds). This model specification allows us to identify the

response of the monetary authorities to different episodes of capital flows, either when they are in the highest and lowest periods, as well as during normal periods. In addition, using a more limited sample (as the method requires a cross-sectional data), this study measures how important are capital flows compared to other variables in the Taylor rule using the BMA approach. Finally, Section 6 discusses the conclusions based on the empirical findings.

4.2. Literature Review

4.2.1. A Review of the Benefits and Drawbacks of the Taylor Rule

The use of the Taylor rule as an appropriate approach for monetary policy decision making has been proven in many countries, as the literature has suggested. Taylor (1993) showed that the Fed's monetary response function related to the interest rate rule when the Fed Funds rate reacted to lagged inflation and output. Clarida et al. (1998) suggested the importance of the Taylor rule, by presenting empirical evidence from two groups of countries, which they called the G3 (US, Germany, Japan) and E3 (UK, Italy, France). A slightly different conclusion was drawn from both groups. While the central banks in the G3 countries are found to follow the forward-looking Taylor rule by adjusting the real interest rate to anticipated inflation, the E3 countries were more influenced by the German Bundesbank's monetary policy. A study by Gerlach and Schnabel (2000) also verified that monetary policy in the EMU countries followed the Taylor rule recommendation, between1990-1998. They found that the average interest rates movement were associated with the average output gaps and inflation. Moreover, Côté et al. (2004) tested a simple monetary policy rule for the Canadian economy and found that the Taylor rule appeared to be one of the most stable rules. Levin et al. (1999) also demonstrated that when the Taylor rule was suitably parameterised, it could robustly assist the conduct of monetary policy in the US. They applied the Taylor-type reaction function with interest rate smoothing and suggested that the results were relatively robust. Martin and Milas (2013) suggested that the UK monetary policy could best be described by the Taylor rule during 1992-2007, before the global financial crisis.

The implementation of the Taylor rule in the US was believed to deliver a high impact on the economy (Taylor, 2013; Clarida et al., 2000), particularly related to the reduced incidence of destabilising expectational shocks over the previous two decades (Bernanke, 2004). Also, Svensson (2003), in the 1995 Federal Open Market Committee (FOMC) meeting, mentioned that the Taylor rule appeared to be a preferable policy rule for the Fed.

According to Yellen, the Federal Reserve Board of Governors during 1994-1997, the Fed real funds rate responded to the changes in deviations of inflation from the target, and in the deviations of actual output from the potential output. Similar findings for the US data are also suggested by Clarida et al. (1998) and Judd and Rudebusch (1998), who concluded that with interest rate smoothing, the Taylor rule framework fits well with the US data, as it could be used to reflect the main components of monetary policy in the US. Moreover, Svensson (2003) also suggested several benefits that a central bank could obtain once it committed to a simple instrument rule. Among others, the benefits come from the simplicity of the instrument rule that ensures the commitment is feasible to achieve, and relatively robust. The robustness of the rule is achievable, when, for example, interest rate smoothing is included. Thus, the rule performs quite well across a variety of models. Taylor (2000) also mentioned that the specific policy rule can also be viewed as a form of transparency. It is very important, in particular for financial markets, for the prediction of short-term interest rates to be a useful signal on what the policymakers are doing and plan to do.

On the other hand, although the empirical findings suggested that the Taylor rule has been proven to perform well in some countries, there are also some criticisms of the rule. One of the recent criticisms was raised by Bernanke (2015), who responded to John Taylor's comments on the Federal Reserve statement presented in the same year. According to Bernanke, although a modified Taylor rule had effectively described US monetary policy since the 1990s, it does not mean that would automatically be the case in the future. Some of the reasons for this are related to the complexity of the underlying judgements of the Fed, which the simple Taylor rule does not cover. Besides that, in practice, the output gap measurement is complicated, where some assessments from the Fed are typically needed. This is not in line with the assumption of the Taylor rule which presumes that the policymakers always have knowledge and agree on the output gap size. Another problem from the Taylor rule is related to the Fed Fund's rate equilibrium (the rate when inflation is equal to the target, and when there is no output gap), which is assumed to be fixed (2% in real term or 4% in nominal terms). In practice, an adjustment is typically required. Furthermore, Bernanke also mentioned that one of the Taylor rules limitations is the lack of guidance when the rule suggests a negative interest rate. Not just for the US, this issue is also particularly crucial for many advanced economies in the post-crisis periods. Lastly, the opinions of the optimal weights on inflation and the output gap in the Taylor rule have achieved no consensus so far. His suggestion is, the optimal weights ideally should satisfy

the policymakers' preferences, as well as the changes to the economy's structure, and the channels of monetary policy transmission.

Svensson (2003) also pointed out several issues related to the Taylor rule: first, there is a possibility that the Taylor rule will not be optimal in countries where other important variables exist, aside from inflation and output gap. Thus, under certain conditions, the rule is possibly different from the optimal setting. Svensson (2000) explained further that the different characteristics between advanced and emerging economies could result in different models. For example, in the US, characterized as a large and not very open economy, inflation and the output gap are considered very important, whilst in smaller and more open economy, other variables such as the real exchange rate, terms of trade, foreign output and foreign interest rates are also crucial as determinants in the model. Secondly, the rule might be suffering from a lack of adjustment and extra-model information which would be difficult to measure. In practice, the central bank may have some other information and judgements that need to be considered when making a decision. In some extraordinary conditions like the Asian economic crisis in 1997-1998 for example, the monetary authorities used their judgement instead of relying on their existing models. This issue was also raised by Caporale et al. (2018), in particular during the stock market crash which occurred in 1987, when the interest rate in the US was sharply cut by the Fed. Similarly, according to Martin and Milas (2013), during the global financial crisis, instead of relying on their monetary policy rule, the Bank of England (BoE) decided to cut interest rates to achieve financial stability in the UK. Another study by Astley et al. (2009) also discussed this phenomenon, when the BoE had made its biggest cut in interest rates since 1964, from 5% to 0.5% during 2008-2009 financial crisis in order to stabilise the banking system.

The third limitation of the Taylor rule as suggested by Svensson (2003) is related to the need for adjustment to be made in the rule. It is less likely that a simple instrument rule could be adapted to new information such as the transmission mechanism, the variability of shocks, or the source of shocks. Fourth, the commitment to a simple rule does not accurately describe current monetary policy. For this reason, the central banks are less likely to explicitly announce that they are committed to a simple instrument rule.

Similar ideas about the Taylor rule limitations were also raised by Hofmann and Bogdanova (2012) who mainly suggested that the traditional Taylor rule might insufficiently capture factors that are important for the financial stability and

macroeconomic conditions. This can lead to downward bias on the policy rate during financial booms and upward bias during the bust periods. Moreover, the simple Taylor rule also has a weakness in capturing the role of other monetary policy instruments, such as changes in reserve requirements.

Another concern of the Taylor rule is related to the measurement of variables such as the inflation rate and output gap. The macroeconomic data frequently suffer from measurement errors and revisions, such as in the GDP and price deflator data series. Moreover, data like the equilibrium interest rate and output gap can contain potential errors in their measurement (Taylor and Williams, 2010). In addition, Orphanides (2003) compared the real-time and the final data of inflation and output gap and found that the standard deviations of the real-time series are larger than the ones in the final data. Moreover, using the estimates of measurement error from the real-time estimates of the output gap, he found that if the policymaker ignores the error, the policy recommendation may lead to a substantial deterioration on the policy outcomes. Therefore, he emphasized the importance of mitigating the information limitations to avoid overreaction in the monetary policy design. This concern was also discussed further by Orphanides et al. (2000) who examined the consequence of inaccuracy in the design of US monetary policy. He suggested that if the output gap forecasting is incorrectly done, it could lead to irrelevant policy decisions. During the 1980-1994 observation periods, they found that although the measurement errors were significant, they were not very noticeable. However, during the 1970s, they observed the inferiority of the output gap in guiding the policy decision, in particular when the economy experienced a substantial structural change and the real estimates of the potential output gap became inconsistent. This condition in turn, could lead to an excessive reaction of the monetary authority.

The issue of the accuracy of potential output calculations are also discussed by McCallum and Nelson (2000). The Hodrick-Prescott (HP) filter, which has been commonly used to calculate the output gap because of its flexibility, posses several limitations, such as the lack of accuracy in the latest observations.

4.2.2. The Augmented Taylor Rule

As proposed by Taylor (1993), the Taylor rule was intended to be a general guideline for the policymakers in deciding their interest rate. The specification of the rule ideally refers to the economic conditions prevalent in a particular country, resulting in the possibility of a different rule across economies. In recent studies, the extended version of the rule has

been the focus of discussions, as it has empirically been outperforming the simple rule in capturing the economic conditions more accurately.

Greater awareness of the negative effects arising from particularly large capital flow reversals adversely affecting the economy has developed recently, generating more recent specifications of the Taylor rule, that considers other important variables such as the exchange rate, asset prices, wealth indicators, interest rate spreads or credit aggregates, such as by Bernanke and Gertler (2000), Taylor (2001), Chadha et al. (2004), Lubik and Schorfheide (2007), Aizenman et al. (2008), Morley and Wei (2012), Bekaert et al. (2013), Martin and Milas (2013), Hafner and Lauwers (2015), Wang et al. (2016), Coeure (2017), Dağlaroğlu et al. (2018), Froyen and Guender (2018), and Caporale et al. (2018).

A. The Augmented Taylor Rule with Exchange Rates

Taylor (2001) developed an augmented Taylor rule by taking into account the exchange rate in his original baseline rule. He explored the existence of the direct and indirect effect of the exchange rate on the interest rate. His findings suggested that although no direct impact was found on the policy rule, there is an indirect impact of the exchange rate on the interest rate setting. This effect, according to Taylor, may lead to less unpredictable fluctuations in the interest rates. Furthermore, his observation on several advanced economies lead to a conclusion that the model including the exchange rate outperformed the baseline rule in some countries such as France and Italy, although it was not the case for Germany. In the countries where the exchange rate matters, the rule implies that the central bank needs to lower the interest rate when the exchange rate increases to higher than normal rates (appreciated), calling for an expansion in monetary policy.

Coeure (2017) from the ECB assessed the basic relationship between the exchange rate and interest rate movements during the period 2005 to 2011. His analysis of the short-term and long-term interest rate suggested a strong correlation between the exchange rate and short-term interest rates, but not with the long-term interest rate differentials. However, near the end of 2011, the connection broke down, which was not surprising as it coincided with the use of unconventional monetary policies around that period. A recent assessment by Froyen and Guender (2018) confirmed the important role of the exchange rate in the Taylor rule. He showed that the optimal monetary policy becomes less aggressive when real exchange rate fluctuations are considered in the model specification, although only a small weight was assigned on this indicator. Therefore, he suggested that once the real exchange rate was incorporated, the performance of the rule was improved compared to the standard

policy rule. Aizenman et al. (2008) investigated the role of the real exchange rate on policy formulations in inflation targeting (IT) for emerging economies. Evaluating the data of 16 emerging markets during the period 1989-2006, they concluded that inflation, as well as the real exchange rates are the most influential factors determining the decisions on policy rates in these economies. Moreover, they also found that the response of the policymakers to the real exchange rate was stronger in the more intensive commodity exporter countries.

Next, Lubik and Schorfheide (2007) focused their research on the responses of the policy authorities to the generic type Taylor rule that accommodates, inflation, output, and the exchange rate movements. Applying the structural general equilibrium model to a small open economy using the Bayesian approach, their estimation results suggested different findings, where the central banks reacted to the nominal exchange rate in Canada and the UK, but not in Australia and New Zealand.

B. The Augmented Taylor Rule with Other Relevant Indicators

As policymakers have recently emphasised financial system stability more, a question which has now been raised is whether it is necessary to include asset price volatility in the monetary policy decision making. The key episodes of medium-term fluctuations have been documented among others by Borio et al. (1994) in the US, UK, Netherland, Sweden, Finland, and Japan over the 1980s. Sometimes, the major boom-bust cycles in equity prices and real estate prices had led to harsh downward corrections. According to Bernanke and Gertler (2000), the bust episodes in asset prices, were particularly associated with times of economic contractions. The current experience of stock price and real estate collapse has also been connected to the poor economic performance in several major economies. The lessons from this are that financial stability is as important as price stability in the monetary policy decision making process. Among the discussions about the importance of asset prices, several studies by Bernanke and Gertler (2000), Chadha et al. (2004), Morley and Wei (2012), Bekaert et al. (2013), Hafner and Lauwers (2015), Wang et al. (2016), Verona et al. (2017), Caporale et al. (2018) are briefly described below.

Bernanke and Gertler (2000) assessed the role of asset price volatility for the Fed policy rate determination in the US over the period 1960-1998. They empirically proved the relevance of asset price volatility for monetary policy decision making only when it helped to forecast the inflationary or deflationary pressures. Another version of the extended rule was by Chadha et al. (2004), who performed an empirical analysis on the inclusion of asset prices and exchange rates into the standard interest rate rule. The observations covered the

periods of 1979 to 2000 for the US, UK and Japan. They suggested that instead of considering asset prices and exchange rates as part of the information set for decision making only, the policymakers should take into account both variables for their Taylor rule specifications. They found that the decision is particularly important in order to counteract a rapid correction in the asset markets, which could lead to economic destabilisation. A study by Morley and Wei (2012) contributed to the current debate on the importance of house price uncertainty in monetary policy setting. Using high-frequency monthly observations between 1987-2007, they found that the uncertainty in house prices was an important factor to consider in the interest rate decision making in the Taylor rule approach. Focusing on the US only, Hafner and Lauwers (2015) investigated whether the Federal Reserve responded to asset price developments during the time period from 1979-2011. Two types of asset are considered in the estimation, namely real estate and equity. The results suggested that over those years, the Federal Reserve had more concern for stock prices, compared to house prices, although they responded only occasionally, when there was a large misalignment in stock prices. In addition, Wang et al. (2016) included asset prices and asset wealth as the representation of asset market movements. Using data from four advanced countries (UK, Sweden, Australia, and the US) over the period 1979-2008, this paper produced different findings, depending on the country and the wealth form. Moreover, the Taylor rule-based exchange rate and wealth-augmented rule were suggested as a better approach compared to the conventional models in their out-of-sample forecasting model.

There has been plenty of empirical evidence that has suggested that the monetary authorities have often responded to changes in financial variables. Among others, Verona et al. (2017) assessed the optimal Taylor interest rate rule in the US when financial variables were accommodated, following a financial shock. They found significant responses of the policymaker to credit growth movements, improving their ability to accomplish their mandate of stabilizing the US economy.

A further study on the Taylor rule has been concerned with the connection between monetary policy with risk indicators. Bekaert et al. (2013) for instance, noticed a strong co-movement between the real interest rates and VIX, which has been a popular measurement of risk aversion in the financial markets. Two components of VIX, the risk aversion and expected stock market volatility (representing the uncertainty) were analysed. This finding from US data during 1990-2010 suggested that both indicators were lessened by a lax monetary policy. In addition, Borio and Zhu (2012) also argued about the need to pay more

attention to the link between monetary policy and the risk-taking channel, in line with transformations in the financial system and prudential regulation.

Another study by Caporale et al. (2018) incorporated a financial index, based on asset prices and financial variables, into a forward-looking monetary policy reaction function. However, the results suggested that there is no clear agreement on whether those variables should be included in the policy rule. In other words, it is still debatable whether central banks need to target the asset price and other financial information to capture the relevant economic conditions when conducting their monetary policy.

Past experience has proved that in reality, a simple monetary policy rule, given the robustness advantages, can work better than complex models or fully optimal rules (Taylor and Williams, 2010). Recently, the search for a better and more robust policy rule has encouraged the policymakers to accommodate a wider model specification and the economic environments. Therefore, the exploration of alternative rules may need to involve international linkages in monetary policy and the economies. As yet, there are a limited number of papers that discuss the influence of international linkages in the rule, particularly one that considers capital flow dynamics directly in the model. The previous discussions mostly argued for the inclusion of its indirect effect on monetary policy via exchange rate pass-through.

Froyen and Guender (2018) for example, described the need to re-examine the open economy Taylor rule, following changes in global financial markets after the crisis hit several advanced economies during 2007-2009. Around this period, some central banks from major economies, including the Federal Reserve decided to purchase a large number of assets and implement near-zero policy rates, which triggered massive capital movement to smaller economies. As a consequence, a currency appreciation was inevitable in some of the recipient economies. When the Fed started to adjust its policy rate back to normal levels, the policymakers were concerned with the possibility of a sudden fall in capital inflows and the opposite effect on the domestic currency. Therefore, he suggested that the central banks, in particular, in small open economies should add exchange rate stability as part of their policy goals. This argument has been supported by Blanchard et al. (2010) in his review of macroeconomic policy. He expressed the need to accommodate the exchange rate objective explicitly in the policy reaction function, in addition to the ultimate goal of achieving a stable output gap and inflation. Furthermore, Taylor (2001) suggested that the

link between the interest rate and the exchange rate existed through capital market interactions.

A study by Dağlaroğlu et al. (2018) investigated how short-term capital flows have meant there is a need for innovative policy measures in a developing economy like Turkey. This paper was motivated by the volatility of capital flows which brought some challenges to domestic financial stability. The variable representing capital flows is approximated by a risk premium indicator using EMBI (JP Morgan Emerging Market Bond Index plus Turkey) and Credit Default Swap Spread (CDS). They argued that a negative shock in the financial market may lead to an increase in the risk premium, which in turn may result in a devalued domestic currency and contribute to an increase in inflation via exchange rate pass-through. By splitting the observations into pre- and post-2010, they found a significant role from global financial factors, as represented by EMBI, and VIX in the augmented Taylor rule in the period after 2010, indicating that interest rate policy in Turkey has been influenced by these external indicators.

4.2.3. The Nonlinear Taylor Rule

A. Studies in Advanced Economies

The recent discussions on the Taylor rule have highlighted whether the responses of the policymakers are constant or vary over time. The latter responses are mostly referred to as nonlinear reactions of the central bank to a specific threshold in the Taylor rule. The previous empirical findings, in general, suggested that the non-linear Taylor rule could better describe the central bank monetary policy decision making process. This means that when the economic conditions change, the central banks show different responses to inflation and the output gap. For example, during high inflation, the central bank might set a higher interest rate than during a low inflation period.

Studies about the nonlinear response of the policymakers have been established both for advanced and emerging economies. In advanced economies, among others, Taylor and Davradakis (2006), Surico (2007), Cukierman and Muscatelli (2008), Castro (2011), Martin and Milas (2013), Caglayan et al. (2016), and Ahmad (2016) have discussed the nonlinear reactions of the policymakers in the US, UK, Canada, and European countries.

Taylor and Davradakis (2006) found a non-linear behaviour for the Bank of England in their monetary policy setting over the period 1992 to 2003, when the UK started to adopt the formal inflation-targeting framework. Although the central bank has stated as an

objective the symmetric inflation target, in reality, the possibility of an asymmetric interest rate setting is inevitable. That was particularly the case when the inflation rate was above the target. The predictability of the rule was claimed as one of the possible reasons for the economic stability in the UK, indicated by the strong growth and price stability during the observation periods. Another finding by Martin and Milas (2013) supported previous research outcomes in the UK, where monetary policy setting needs to tolerate the behavioural changes of policymakers. To analyse which approach is better, they estimate several alternative models, including one with a threshold effect. Using observations between 1992-2010, this study concluded that the Bank of England's interest rate setting followed the simple Taylor rule before 2007. Since then, the interest rate response to inflation and the output gap had declined significantly. Their empirical findings also suggested a significant reaction of the interest rate to inflation and the output gap during the "no crisis" regime, but it was not substantial during the "financial crisis" regime. In the latter regime, only a weak reaction to the output gap, and no significant response to the inflation rate is captured, suggesting that the threshold model is more superior compared to the constant parameter policy rule.

An empirical analysis using the New-Keynesian framework for the open economy in Canada and the UK was conducted by Caglayan et al. (2016) over the period 1983-2007. They confirm the presence of asymmetric responses of both policymakers to inflation and output gap deviations from the targets. The findings showed that while the Bank of England had positive asymmetric responses to both inflation and output gap, the Bank of Canada demonstrated asymmetric negative reactions to the output gap, which means that the central bank interest rate reaction function was responsive when the output gap declined below the target. Castro (2011), over the period 1999-2007, also showed the existence of non-linear monetary policy of the Bank of England and the European Central Bank (ECB). Using a forward-looking Taylor rule with additional variables to capture the financial conditions, he found that the nonlinear rule best described the interest rate response of both central banks. However, it was not the case for the Federal Reserve policy, which followed the linear Taylor rule.

B. Studies in Emerging Economies

While there are numerous empirical studies on the nonlinear Taylor rule in advanced economies, given a relatively short period of observations, similar studies in emerging economies are still limited (Miles and Schreyer, 2012). Among others, some research

targeting these economies have been conducted by Hasanov and Omay (2008), Moura and Carvalho (2010), Akyurek et al. (2011), Miles and Schreyer (2012), Akdoğan (2015), and Caporale et al. (2018).

Miles and Schreyer (2012) focused their studies on four emerging economies in Asia: Indonesia, Korea, Malaysia, and Thailand, during the period 1985-2010. Depending on the data availability in each country, overall, the results implied a nonlinear preference by the central banks when conducting monetary policy in all four sample countries. Another paper by Moura and Carvalho (2010) examined how policymakers in some of the largest economies in Latin America conducted their monetary policy during 1999-2008. The selected countries consisted of Brazil, Argentina, Mexico, Chile, Colombia, Venezuela and Peru, which were categorized based on their levels of development. The countries also have similarities in monetary policy frameworks and exchange rate regimes. They examined 16 variants of the Taylor rule, covering the backward and forward-looking models, with several additional variables aside from inflation and the output gap. Dummy variables reflecting the stages of inflation and industrial production growth are added to the model to represent the asymmetric response of the interest rates. The results supported previous findings that the Taylor rule could explain monetary policy in all observed countries.

Akdoğan (2015) focused his research on observing the asymmetric behaviour of the policymakers to inflation in 14 emerging economies (Brazil, Chile, Colombia, Czech Republic, Hungary, India, Mexico, Peru, Philippines, Poland, Romania, South Africa, Thailand, Turkey) and five developed economies (Canada, Israel, Norway, Sweden and United Kingdom). The observations begin when the countries start to adopt the Inflation Targeting Framework (IT) up until 2013. He found that central banks in some countries responded asymmetrically to inflation, which tended to be greater when the inflation deviation was above the target level. Another study on the asymmetric reaction function of the policymakers was performed by Sá and Portugal (2015). A non-parametric approach was applied to Brazil and the US data over the period 1999-2011 and 1960-2011 respectively. Once different weights were assigned to inflation and the output gap, the results indicated that the Federal Reserve responded asymmetrically to the inflation rate, as more attention was assigned when the inflation dropped under the target. However, it was not the case during the Volcker-Greenspan period. Meanwhile, the Central Bank of Brazil showed asymmetric behaviour with more concern for a positive output gap, particularly since 2004.

In Turkey, Hasanov and Omay (2008) observed how the policymakers responded to deviations in inflation and output gap during the period 1990-2000. Again, their findings suggested an asymmetric behaviour by the Central Bank of the Republic of Turkey (CBRT). During an economic downturn, the central bank focused more on output stabilisation. However, Turkey experienced difficulties in decreasing the inflation rate during the observation period, as the monetary policy was very accommodative. One of the most recent studies by Caporale et al. (2018) aimed to explore whether the monetary policy in 5 emerging countries (Indonesia, Israel, South Korea, Thailand and Turkey), who implemented Inflation Targeting and floating exchange rates can best be described by the Taylor rule. The observation periods varied, depending on the starting date of the Inflation Targeting up until 2015. They found that the interest rate setting behaviour of the monetary authorities in the sample followed the nonlinear Taylor rule. In other words, the central bank responded more aggressively to the deviations from the inflation target during high inflation regimes.

4.3. Data and Measurement

The sample of this study consists of 34 countries, covering 10 advanced and 24 emerging economies, which have adopted an Inflation Targeting framework (IT) (Table A4-1). Under this framework, the central banks are required to announce their inflation target to the public. The inflation target data used in this study is only available once the country has started to implement the framework. Consequently, although the observation period is from 1990 to 2018, the length of observations in each country depends on the IT starting date, resulting in unbalanced observations. In addition to the countries that have adopted IT formally, the United States is also included in the sample, as many studies of the Taylor rule have been done earlier for this particular country. Moreover, the Federal Reserve has been constantly sending out signals of its inflation target to the public. Some of the advanced countries started IT in the early 1990s. New Zealand was the first one to adopt the framework in 1990, followed by Canada in 1991, the United Kingdom in 1992, Australia and Sweden in 1993. From the emerging economies, Israel has informally followed IT since 1992, and finally implemented a fully-fledged inflation targeting policy in 1997, similar to the Czech Republic. Some countries with the shortest length of observations are Russia and India, who have implemented IT since 2015. The IT starting dates for each country can be found in Table A4-1. Due to data availability, this study covers only 34 out of the 38 potential countries that are currently listed as formal inflation

targeters, in addition to the US. Except for Iceland, because of this reason, Albania, Khazakstan, Guatemala, and Serbia are not included in the sample[14].

The dependent variable in the estimations are the policy rates, which refer to the central bank's policy rates in each country. The main source of this data is from the Bank for International Settlements (BIS). However, for some countries, when they are not available, the data have been obtained from the central bank website in the individual countries. The other six variables used as the regressors are mainly gathered from the Bank for International Settlements (BIS), the International Monetary Fund (IMF): Balance of Payment (BOP), International Financial Statistics (IFS), and the World Bank database: World Development Indicators (WDI). Other sources are the central bank's websites, and the CEIC database.

Other than the volatility indicator (VIX) which is stated in an index, other variables are measured either in percentage or percentage of GDP form, as shown in Table 4-1. The GDP variable, which was originally measured in constant USD (2010=100), is firstly converted into the log form before estimating its trend values using HP filters. The main variables in the equations (inflation, GDP, and REER) are calculated in gap form. The GDP gap is calculated by subtracting the trend (long term) value of GDP that has been estimated using the HP filters from the real GDP. Once the difference is obtained, the next step is dividing the gap by the trend of GDP and multiplying it by 100% to get the GDP gap percentage. A similar technique was also applied to compute the Real Effective Exchange Rates (REER) gap. Finally, for the inflation gap, it is simply the deduction of the inflation target which has been set by the central banks from the actual inflation rates.

In line with the main objective in this study, the Taylor rule extension involves including capital flows variables. Here the analysis is focused on two types of capital flow categories, namely direct investment and portfolio investment. Other investment is excluded from the analysis because this type of flow is typically very volatile and containing some residual category which covers the positions and transactions other than those counted in direct investment, portfolio investment, financial derivatives and employee stock options, and

[14] Compared to other countries, the capital flows variable is very volatile in the last 2 decades, particularly after the global financial crisis. Although the data for Iceland is available, I do not include it in the sample.

reserve assets[15]. In addition, the last three categories (financial derivatives and employee stock options, and reserve assets) are not included since their amount are not significant.

Table 4-1. List of Variables and Data Sources

No	Variable	Source	Unit
1	Policy Rates	Bank for International Settlements (BIS), Central Bank Websites	Percent
2	Inflation Gap	World Development Indicators (WDI), Central Bank Websites	Percent
3	GDP Gap	World Development Indicators (WDI), Bank for International Settlements (BIS)	Percent
4	REER Gap	World Development Indicators (WDI), BIS	Percent
5	Capital Inflows & Outflows	Balance of Payment (BOP), International Financial Statistics (IFS)	Percent of GDP
6	Fed Fund Rate	International Financial Statistics (IFS)	Percent
7	VIX	Chicago Board Options Exchange (CBOE)	Index

In addition to the analysis of capital inflows, the Taylor rule with the capital outflows variable is also estimated. As described by IFS, capital inflows refer to the flows on the liabilities side of the BOP (which corresponds to the "foreign-owned" investment), while capital outflows denote the assets side (which relates to the "domestic-owned" investment)[16]. Capital inflows and outflows are measured as the percentage of GDP, thus, its current values from the original data is divided by the nominal GDP. The summary statistics of all variables included in the estimations are presented in Table A4-2 in the appendices.

The second estimation section of this chapter discusses the inclusion probability of the variables in the augmented Taylor rule, aside from the global indicators like FFR and VIX. One possible approach involves using the Bayesian Model Averaging. This approach allows us to explore how important the capital flows are compared to other indicators. Although a limited number of variables are included in the model, this method can help to

[15] See the Balance of Payments and International Investment Position Manual/BPM6 (IMF, 2014) for further definition of all types of capital flows.

[16] The capital flows data, based on the IFS standard code used in this paper are: Direct Investment, Liabilities (BFDLXF_BP6_USD), Portfolio Investment, Liabilities (BFPLXF_BP6_USD), Direct Investment, Assets (BFDA_BP6_USD), and Portfolio Investment, Assets (BFPA_BP6_USD).

explore the most influential indicator that the policymakers should consider responding to. However, this technique requires a cross-sectional data, thus, the average values of all variables are calculated before the estimation.

4.4. Methodology

4.4.1. The Taylor Rule Model

In Taylor (1993), John Taylor proposed a simple interest rate rule that focused on the adjustment of the central bank's short-term interest rate instrument as a response to the state of the economy. His original Taylor rule was expressed as a representative rule for monetary policy in the United States as:

$$r_t = \pi_t + 0.5y_t + 0.5(\pi_t - \pi^*) + r^* \quad (4.1)$$

or in a more specific way when the target rate of inflation is set at 2% it can be expressed as:

$$r_t = \pi_t + 0.5y_t + 0.5(\pi_t - 2) + 2 \quad (4.2)$$

where:

r_t: the federal funds rate,

r^*: the equilibrium real fed funds rate,

π_t: the inflation rate,

π^*: the target of inflation rate,

y_t: the output gap, which represents the deviation of real GDP from the target.

Under this rule, the Federal Reserve should raise the interest rate when the inflation rate goes up above a target of 2%, or when the real GDP exceeds the trend GDP. It is also suggested that when there is no deviation from the target, or in other words when inflation and the real GDP meet the target, the policy rate is equal to 4%, or in real terms is equal to 2%. In this formula, Taylor argued that the 2% equilibrium real rate was close to the assumption of the steady-state growth rate of 2.2% in the US during that period. This size of responses, according to Taylor, described the actual policy actions by the Federal Reserve which was fairly accurate during those years. Although no clear consensus on how much weight is appropriate on the parameters, Taylor argued that the rule in equation (4.2) is forthright and simple and suits recent studies in the US around that period.

In the latter study (Taylor, 1999), this benchmark rule was modified by including the inflation targets and the estimate of the real interest rate equilibrium in the model. Covering those variables together, the adjusted Taylor rule was specified as:

$$r_t = \pi_t + gy_t + h(\pi_t - \pi^*) + r_t^f \quad (4.3)$$

where:

r_t: the short-term interest rate

y_t: the percentage deviation of real output from the trend

h : the amount of the central bank's response to a rise in inflation, expressed by an increase in the real interest rate $(r_t - \pi_t)$

π_t: the inflation rate, measured as the percentage change in P

π^*: the target of the inflation rate set by the central bank

r_t^f : the estimate of real interest rate equilibrium

Furthermore, Taylor associated this formula with his previous policy rule from Taylor (1993), that is achieved if $g = 0.5$, h=0.5, $\pi^* = 2$, and $r_t^f = 2$. However, regarding the size of g, to accommodate other alternatives, Taylor also considered the larger size of g in the baseline model, thus, setting g=1. Finally, Taylor implied that this policy rule was established as a normative guideline formula or general policy framework for the central bank to assess their decisions on the interest rate. In fact, some discretion might be needed to implement the rule.

Judd and Rudebusch (1998), based on the original Taylor rule, modified the equation by taking into account interest rate smoothing (the lag of interest rates). This variable is considered to allow for a gradual adjustment of the fed funds rate to achieve the suggested rate. The adapted rule is denoted as follows:

$$i_t^* = \pi_t + r^* + \lambda_1(\pi_t - \pi^*) + \lambda_2 y_t + \lambda_3 y_{t-1} \quad (4.4)$$

where i_t^* is the suggested rate, that is achieved through gradual adjustment. The λ is included to allow for the possibility of the central bank's reaction to the proposed indicators in the monetary policy targets, or only to inflation, that is when $\lambda_1, \lambda_2, \lambda_3 = 0$.

In the more recent Taylor rule literature, the baseline specification has been augmented further by including the role of the exchange rate. Among others, Taylor (2001), Svensson (2000), Ghosh et al. (2016), and Wang et al. (2016), highlighted the influence of the

exchange rates in the Taylor rule, as it captures the monetary response more accurately. The equation below expresses this augmented rule as discussed in Taylor (2001):

$$i_t = f\pi_t + gy_t + h_0 e_t + h_1 e_{t-1} \tag{4.5}$$

As in the previous equations, i_t is the short-term nominal interest rate, π_t represents the inflation rate, y_t symbolises the output gap, that is the deviation of actual GDP from the potential GDP, and e_t is the real exchange rate. An increasing exchange rate corresponds to a real appreciation of the currency. According to Taylor, equation (4.5) represents a simple monetary policy rule, which can be augmented to a more complex non-linear form with the inclusion of other lagged variables. The lack of an intercept in equation (4.5), implies that the targeted inflation rate is zero. Also, the interest rates and exchange rates are measured relative to their long-run (long-run steady-state) values. This policy rule will be similar to Taylor (1993) when the parameter of f>1, $g > 0, h_0 = 0,$ and $h_1 = 0,$ implying the excluding of the exchange rate from the model.

4.4.2. Model Specification

Taylor and Williams (2010) suggested that it is important to evaluate the policy rules so as to identify the most relevant characteristics in the rules which are more robust to model specifications. Motivated by the original Taylor rule in Taylor (1993) and the related studies afterwards, I follow the literature in constructing the baseline and augmented policy rule. To capture the interest rate dynamics, the interest rate smoothing is included in the model. It is represented by the lagged interest rate, in addition to the standard indicators (inflation and output gap) and other variables (exchange rates, capital flows, fed funds rate, and VIX) as in the equations below:

a. Baseline Taylor Rule

$$r_{i,t} = f(\pi_{i,t} - \pi_{i,t}^{*}) + gy_{i,t} + \varepsilon_{i,t} \tag{4.6}$$

b. Augmented Taylor Rule

1) With no threshold on capital flows

$$r_{i,t} = f(\pi_{i,t} - \pi_{i,t}^{*}) + gy_{i,t} + he_{i,t} + kcf_{i,t} + mz_{i,t} + \varepsilon_{i,t} \tag{4.7}$$

2) With the threshold on capital flows

- During extreme capital flows episodes:

$$r_{i,t} = f(\pi_{i,t} - \pi_{i,t}^{*}) + gy_{i,t} + he_{i,t} + k(I[cf_{i,t} \geq cf^{**}]\, cf_{i,t} + I[cf_{i,t} \leq cf^{*}]\, cf_{i,t}) + mz_{i,t} + \varepsilon_{i,t} \tag{4.8}$$

- During normal capital flows episodes:

$$r_{i,t} = f(\pi_{i,t} - \pi_{i,t}^{*}) + gy_{i,t} + he_{i,t} + k(I[cf_{i,t} < cf^{**}]\, cf_{i,t} + I[cf_{i,t} > cf^{*}]\, cf_{i,t}) + mz_{i,t} + \varepsilon_{i,t} \quad (4.9)$$

where:

$r_{i,t}$: the policy rate of the central bank

$\pi_{i,t}$: the inflation rate

$\pi_{i,t}^{*}$: the inflation target set by the central bank

$y_{i,t}$: the output gap, which shows the deviation of actual GDP from the potential GDP

$e_{i,t}$: the exchange rate deviation from its long-term (trend) value

$cf_{i,t}$: the capital flows, corresponding to capital inflows or capital outflows, which will be separately estimated

$z_{i,t}$: the set of extended variables, comprising the fed funds rate and the VIX volatility index

cf^{**} : the upper threshold band of capital flows, that is set to the 90th percentile, as an approximation of the large capital flows episodes

cf^{*} : the lower threshold band of capital flows, that is set to the 10th percentile, as an approximation of the low capital flows episodes

$I[.]$: the dummy indicator that set to 1 if $cf_{i,t} \geq cf^{**}$ and $cf_{i,t} \leq cf^{*}$, and 0 otherwise, during extreme capital flows episodes, or $cf_{i,t} < cf^{**}$ and $cf_{i,t} > cf^{*}$, and 0 otherwise, during normal periods.

$\varepsilon_{i,t}$: the error term

f, g, h, k, m : the parameter estimates of inflation gap, output gap, exchange rate gap, capital flows, and global variables respectively

In addition to equation (4.7) for non-threshold model, equations (4.8) & (4.9) represent the main interest in the way that capital flows are chosen as the threshold variable. This study presumes that the monetary policy authorities have a direct response to capital flow dynamics. In particular, it assesses empirically the policy reactions during unusual and normal capital flow periods.

In addition, the model specification also reveals that both the domestic and international dimension are considered. The latter is represented by two international factors: the fed funds rate and VIX volatility index, that symbolises the global risk appetite of the foreign investors. The connection between monetary policy and the risk indicator has been

previously discussed for example by Bekaert et al. (2013), who found a strong co-movement between real interest rates and the VIX, as the proxy for the risk appetite of international investors. Additionally, a study in the US by Bruno and Shin (2015) discovered that the higher fed funds rate corresponds to greater risk aversion in the VIX. Besides that, Dağlaroğlu et al. (2018) found a significant role for VIX in the short-term monetary policy rate in Turkey.

The dominant role of the US Dollar in international trade and finance within the global economy has encouraged the policymakers to pay more attention to the Federal Reserve's policy decision (Bernanke 2015). The previous experience has also shown how the interest rates of a major economic player like the fed funds rate can have an influence on the direction of capital flows to emerging countries (Ahmed and Zlate, 2014). Froyen and Guender (2018) also described the phenomenon of policy changes that took place following the financial crisis in 2007-2009. Around this period, some central banks from major economies, including the Federal Reserve decided to purchase a large number of assets and implement near-zero policy rates, which triggered massive capital movements to smaller economies. In addition, Takats and Vela (2014) among others also suggested that US monetary conditions have driven the policy rates in emerging economies. Moreover, they found a significant relationship between the long-term interest rate in the US with the long-term interest rates in emerging countries. The co-movement of those long-term interest rates was stronger following the global financial crisis periods. The IMF (2016a) in their report about monetary policy frameworks in ASEAN-5 countries, also suggested an association of the higher US short-term interest rate with the policy rates in the ASEAN-5 countries. Furthermore, Hofmann and Bogdanova (2012) recommended the policymakers to reconsider their monetary policy rules, given the recent experience of global interest rate deviations from the Taylor rule since the early 2000s. They suggested that the central banks also need to pay attention to the different stages of the financial cycle and on the global monetary spillovers when conducting their monetary policy.

4.4.3. Estimation Methods

This study applies the Arellano Bond estimator to estimate the baseline and augmented Taylor rule models as specified in the equation (4.6) to (4.9). This estimator allows us to incorporate p-lags of the dependent variable in the regressors, as well as the unobserved panel level effects. Using the standard estimators, in this case, will be inconsistent, since, by design, the unobserved panel level effects are correlated with the lag of the dependent

variable. Since being introduced by Arellano and Bond (1991), this dynamic model has been widely applied in many empirical studies with panel data.

As explained in Baltagi (2005), one of the advantages of panel data analysis is that it allows for a better understanding of the dynamics of adjustment. This dynamic characteristic typically exists in economic relationships, which is portrayed by the lagged dependent variable in the covariates list.

$$y_{it} = \delta y_{i,t-1} + x'_{it}\beta + u_{it} \qquad \text{i=1,…,N;} \quad \text{t=1,…,T} \tag{4.10}$$

where δ is a scalar, x'_{it} is 1 x K and β is K x 1. Here we assume that u_{it} is following a one-way error component model:

$$u_{it} = \mu_i + v_{it} \tag{4.11}$$

where μ_i~IID(0, σ_V^2) and v_{it}~IID(0, σ_V^2) are independent of each other and among themselves.

Without incorporating the lagged dependent variable in the equations above may generate estimates that suffer from autocorrelation, because when y_{it} is the function of u_{it}, then it will also be the case for $y_{i,t-1}$. Thus, it is clear that there is a correlation between $y_{i,t-1}$ and the error term. As a consequence, the OLS estimator is not appropriate, as the estimation results will be biased and inconsistent, even if the v_{it} are not serially correlated.

In addition, Baltagi (2005) also explained the persistence concern overtime in equation (4.10) and (4.11), originated from the autocorrelation caused by the lagged dependent variable in the regressors, and from the heterogeneity between the individuals. The within transformation removes the μ_i in the fixed effect estimator, except for $(y_{i,t-1} - \bar{y}_{i.-1})$ where $\bar{y}_{i.-1} = \sum_{t=2}^{T} \frac{y_{i,t-1}}{T-1}$, which is still correlated with $v_{it} - \bar{v}_{i.}$, even though the v_{it} are not serially correlated. Therefore, the within estimator will be biased. However, the consistency relies on the size of T. This implies that with fixed T and large N, the within estimator can lead to biased and inconsistent results.

Among others, Arellano and Bond (1991) suggested a more efficient technique through the generalized method of moments (GMM) procedure. It is accomplished by adding the instruments obtained from utilising the orthogonality conditions between $y_{i,t-1}$ and v_{it}. First differencing the equation helps to remove the individual effects and the related omitted variable bias. The set of valid instruments may comprise appropriate lags of the levels of the endogenous variables as well as other specified variables (Wooldridge, 2006). When the number of instruments becomes very large, one might need to impose a

restriction on the maximum number of instruments considered in the estimation. To anticipate the issue of having too large a number of instruments imposed on the estimation, the standard moment conditions is followed by utilizing the lags of the dependent variable and first differences of the exogenous variables as instruments for the first differenced equation in the estimations.

4.4.4. Unit Root Test

This study uses the Phillip Perron and Augmented Dicky Fuller (ADF) tests for unbalanced panel data to test for the stationarity of all variables (Choi, 2001; Baltagi, 2005). Based on the unit root tests, all variables are stationary in levels[17]. The unit root test result is presented in Table 4-2. Time trend is included in the unit root test to account for the trend stationarity.

Table 4-2. Augmented Dickey-Fuller & Philip Perron Unit Root Test Results for the Taylor Rule Variables

Variable	ADF		Philip Perron	
	Statistic	**P-value**	**Statistic**	**P-value**
Policy Rates	-6.26	0.00	-4.64	0.00
Inflation Gap	-8.81	0.00	-8.42	0.00
Output Gap	-3.27	0.00	-3.38	0.00
REER Gap	-5.18	0.00	-2.83	0.00
Capital Inflows	-1.26	0.10	-8.85	0.00
Capital Outflows	-6.09	0.00	-11.19	0.00
Fed Fund Rate (FFR)	-5.23	0.00	-1.62	0.05
Volatility Index (VIX)	-8.80	0.00	-4.79	0.00

Notes: H0: All panels contain unit roots; Ha: At least one panel is stationary; a trend term is included to account for the trend stationarity; the stationarity test is based on the inverse normal (Z) statistics.

[17] Similar unit root tests have also performed for the disaggregated samples. The results showed analogous outputs, where all variables are stationary at level in both emerging and advanced economies.

4.5. Empirical Results

4.5.1. The Baseline Taylor Rule

The policymaker's behaviour that follows a typical Taylor rule can be reflected by their response to the deviations in inflation and the output gap from their targets. Using annual unbalanced panel data over the period 1990-2018, in this section evidence is presented on the baseline Taylor rule model, to represent the original central bank monetary policy as in Taylor (1993). In this scenario, to capture the interest rate dynamics, following the literature on the smoothing of the policy rate, the lagged interest rate is included in the regressors.

Although this chapter mainly aims to explore the setting of monetary policy in the inflation targeting emerging and advanced economies, estimation for the total sample is also performed for comparison purposes. Table 4-3 reports the estimation of the baseline model under two scenarios: before and after controlling for the global financial crisis 2008-2009, as represented by dummy crisis variables on the right of the table. Although the results in both tables are similar, the addition of the crisis dummy variable is noteworthy, since its parameter estimate is strongly significant in all samples.

Overall, the estimation outcomes are in line with our expectation in all sample categories. The sign of the parameter estimates of the variables is in line with the Taylor rule theory. For the inflation gap, for example, the positive estimated parameters indicate that when the inflation gap is rising, the central bank is responding by increasing the policy rates. Correspondingly, the estimated parameter of the output gap also has a positive sign, suggesting a similar reaction of the central bank when the actual output continuously is higher than the potential output.

The estimation output indicates a consistent result with the previous panel empirical studies in terms of the important role of indicators on the policy rule. The sign and magnitudes of parameter estimates overall are partly in line with for example Aizenman et al. (2008), Ghosh et al. (2016) and Castro (2011). As predicted the smoothing variable, represented by the first lag of the interest rate, shows a very substantial influence on the setting of monetary policy in the IT emerging and advanced economies. In both sets of economies, the output gap has consistently been considered as one of the major factors by the central bank when setting their interest rates. The main difference between the two economies lies in the inflation gap parameter estimate, which is a powerful indicator for the central banks in emerging economies. The magnitude of the coefficient suggests that a 1% increase in

inflation gap leads to a 0.529% rise in the policy rates in emerging economies. Whilst for advanced economies, this indicator is not statistically significant, suggesting little role for inflation in setting the policy interest rate. This finding is not totally unexpected although they have both in fact adopted the IT. A previous study by Martin and Milas (2013) suggested that monetary policy in the UK followed the Taylor rule only in the periods before 2007. After the financial crisis, the Bank of England response to inflation has reduced substantially and become no longer significant. Furthermore, during the crisis regime, their financial stress variable becomes very influential. The authors believe that even though the UK monetary policy rule had changed during the crisis, their empirical estimations could not capture the reasons for the changes, as it will also call for joint estimations and examination on the relationship of the aggregate demand and supply. However, they stated that the changes in parameter estimates in the policy rule might be due to the different preferences of the monetary authority and possibly because of the changes in the UK's macroeconomic structure as appeared in the aggregated demand and supply relationship.

Table 4-3. The Estimation Results of the Baseline Taylor Rule

(Model 1)

Without GFC Dummy Variable

Variable	Emerging Economies	Advanced Economies	All Economies
Lag Policy Rates	0.523***	0.767***	0.594***
	(0.08)	(0.04)	(0.06)
Inflation Gap	0.474***	-0.053	0.389***
	(0.11)	(0.08)	(0.11)
GDP Gap	2.152**	4.206***	2.737***
	(0.90)	(0.83)	(0.77)
Constant	2.526***	0.580***	1.801***
	(0.56)	(0.18)	(0.37)
Observations	304	186	490
$Prob > \chi^2$	0.00	0.00	0.00

With GFC Dummy Variable

Variable	Emerging Economies	Advanced Economies	All Economies
Lag Policy Rates	0.536***	0.778***	0.605***
	(0.07)	(0.04)	(0.06)
Inflation Gap	0.529***	0.030	0.451***
	(0.11)	(0.08)	(0.11)
GDP Gap	2.300**	3.078***	2.599***
	(0.95)	(0.92)	(0.80)
GFC Dummy	-1.512***	-1.751***	-1.609***
	(0.35)	(0.16)	(0.23)
Constant	2.566***	0.696***	1.879***
	(0.54)	(0.17)	(0.35)
Observations	304	186	490
$Prob > \chi^2$	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

4.5.2. The Augmented Taylor Rule

This section discusses the augmented version of the Taylor rule that allows for an extension from the baseline model by adding other relevant variables such as the exchange rate, capital flows, and global uncertainty. Following the literature, for example Borio and Zhu (2012), Bekaert et al. (2013), and Daglaroglu et al. (2018), the VIX volatility index is included in the model to represent the global uncertainty. In addition, the fed funds rate is incorporated in the extended rules, since it has been widely discussed as one of the most important indicators in cross-border policy transmission (Bruno and Shin (2015) and Bernanke (2015). Bernanke advised that the dominant role of the US Dollar in international trade and finance within the global economy has encouraged the policymakers to pay more attention to the Fed's policy decision. Moreover, Takats and Vela (2014) implied that US monetary conditions have driven the policy rates in emerging economies. They also found that the co-movement of long-term interest rate in the US with the long-term interest rates in these countries was stronger following the global financial crisis periods.

4.5.2.1. Taylor Rule with Exchange Rates Indicator

As the models are extended with an exchange rate variable (Table 4-4), the findings obtained are comparable with the ones from baseline model. The parameter estimates of the exchange rate do not show a substantial impact on the interest rate setting in advanced economies. In contrast, in emerging economies, the exchange rate has been considered as one of the most important variables for monetary policy. The result suggests that a 1% increase in the exchange rates appreciation is associated with a 0.085% rise in the policy rates in emerging economies. This finding supports previous discussions about the important role of exchange rates for monetary policy decision in IT emerging economies. In terms of the sign and magnitude of the REER, the result is comparable with Markov and Nitschka (2013) and Ghosh et al. (2016). As expected, the coefficient for the REER gap has a negative sign, indicating that when the exchange rate appreciation becomes too high, the central banks in emerging economies are expected to cut the interest rates. This finding is also in line with the rule of thumb interpretation from Obstfeld and Rogoff (1995) who suggested that the central bank should lower their interest rate when the real exchange rate is higher than normal levels.

Table 4-4. The Estimation Results of the Taylor Rule with Exchange Rates Indicator (Model 2)

Without GFC Dummy Variable

Variable	Emerging Economies	Advanced Economies	All Economies
Lag Policy Rates	0.517***	0.764***	0.592***
	(0.08)	(0.04)	(0.06)
Inflation Gap	0.424***	-0.039	0.363***
	(0.10)	(0.08)	(0.10)
GDP Gap	4.075***	4.002***	3.767***
	(0.91)	(0.74)	(0.85)
REER Gap	-0.096***	0.006	-0.046**
	(0.02)	(0.01)	(0.02)
Constant	2.593***	0.592***	1.818***
	(0.59)	(0.19)	(0.37)
Observations	304	186	490
$Prob > \chi^2$	0.00	0.00	0.00

With GFC Dummy Variable

Variable	Emerging Economies	Advanced Economies	All Economies
Lag Policy Rates	0.527***	0.780***	0.602***
	(0.07)	(0.04)	(0.05)
Inflation Gap	0.478***	0.018	0.425***
	(0.10)	(0.08)	(0.10)
GDP Gap	3.990***	3.261***	3.584***
	(0.91)	(0.90)	(0.86)
REER Gap	-0.085***	-0.006	-0.044***
	(0.02)	(0.01)	(0.02)
GFC Dummy	-1.322***	-1.769***	-1.602***
	(0.31)	(0.16)	(0.23)
Constant	2.624***	0.686***	1.893***
	(0.57)	(0.18)	(0.36)
Observations	304	186	490
$Prob > \chi^2$	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

The role of the exchange rate in the policy rule in inflation targeting emerging economies have also been discussed by Aizenman et al. (2008). In addition, Taylor (2000) mentioned that the exchange rate fluctuations have been an important variable to monitor for emerging economies, compared to advanced countries. Therefore, the monetary authorities in these countries often include the exchange rate in their policy evaluations. However, Taylor also explained that while several studies found that in many policy evaluations models, the exchange rate has been a significant measure in the transmission mechanism, others have observed that the central banks had not reacted substantially to this variable.

4.5.2.2. Taylor Rule with No Threshold on the Capital Inflows

In terms of the augmented Taylor rule with the capital flows variable, the first part of the analysis emphasizes the cross-border investment flows that are associated with foreign financial flows. Therefore, the main discussion involves the liabilities (inflows) side of direct and portfolio investment in the Balance of Payment (BOP). Positive capital inflows are associated with more foreign investment to the receiving economies. Similarly, negative capital inflows indicate a reversal of foreign investment from the receiving economies. In line with the main interest in this study, the analysis will be based on the role

of foreign financial inflows. Furthermore, this study also intends to explore whether capital outflows influence interest rates decisions for the IT countries. Given the high correlation between capital inflows and outflows, the estimation of Taylor rule with capital outflows is performed separately in the next section.

Assuming a linear relationship between capital inflows and the interest rate setting, there is no threshold applied in this first section. Table 4-5 and Table 4-6 present the outcome of the Taylor rule estimations with no threshold for capital inflows as in Model 3-6. The first table displays the estimates once the global financial crisis dummy variable has been taken into account. As the crisis dummy variable always shows a strong influence in all models, the results in Table 4-5 will be the main reference. Also, since the global financial crisis in 2008-2009, the movement of capital flows across countries has led to increased awareness by policymakers around the world. The episodes of large capital inflows and outflows may have particularly affected their policy decisions.

Although there are no significant differences between the two findings, compared to Table 4-6, the monetary policy response is stronger to capital inflows in advanced economies in Table 4-5. Thus, without controlling for the crisis variable, the capital inflows variable shows a weak influence on the policy rate decisions in these economies. Furthermore, unlike advanced economies, capital inflows appear to be an important consideration for the setting of the interest rates in emerging economies during the IT time periods.

Both global variables, the Fed Fund Rate (FFR) and the VIX index are included in Model 4 and Model 6. The results demonstrate how important the FFR is for the central banks' decision in all IT countries in the sample. Given the fact that the US is one of the dominant economic players which can influence policy setting in other countries, this finding is as expected. The positive sign on the FFR estimated parameter indicates that the countries tend to increase their policy rates when the Fed raises the FFR. Moreover, the market expectations with regard to volatility measurements (VIX index), confirms a significant effect on the interest rates in emerging economies. An increased financial risk, which is indicated by a higher VIX index, will be followed by a rise in the interest rates by the central banks in emerging economies. This finding is in line with a previous study by Daglaroglu et al. (2018) who investigated the significant role of VIX for monetary policy setting in the case of Turkey. Moreover, it supports Borio and Zhu (2012) who suggested the need to pay more attention to the link between monetary policy and the risk-taking channel.

Overall, under the extended models presented in Models 3-6, the inflation gap, exchange rates and the VIX volatility indicators are the most crucial factors for monetary policy setting in emerging economies. In advanced economies, these variables are not the main indicators for setting their interest rates. The finding related to the exchange rate's role in developed countries is not a surprise, given the fact that emerging economies generally have a greater concern for exchange rate fluctuations than most advanced economies, as they tend to be more volatile. Like inflation, the output gap has always been an important consideration for interest rate setting in both economies, except in Model 5 and Model 6, once the global factors (FFR and VIX) are controlled.

Finally, in all augmented models, besides the interest rate smoothing variable, capital inflows, global interest rates (FFR) and the global financial crisis dummy variable are equally important for the central banks in both emerging and advanced economies. This finding indicates that international influences have become more important for policymakers in IT countries. Nevertheless, when it comes to a policy decision, the authorities might need to consider a single model that is in accordance with their priority. Among several alternative models, the estimations result in model 4 presents well the main interest of this study, that is extending the Taylor rule in Taylor (2001) (Taylor rule with exchange rates indicator) with capital flows dynamics. As showed in Table 4-5, after considering capital flows in the model, we still obtain the expected χ^2 test result. Although the Wald χ^2 is not the highest (Table A4-5 in the appendices) across the models, the null hypothesis of all coefficients being equal to zero is strongly rejected. From this point of view, capital inflows have been similarly important for policy decisions as other variables in Taylor (2001), particularly in emerging economies. In this model, a 1% increase in capital inflows relative to GDP is associated with a 0.02% and 0.05% rise in the policy rates in emerging and advanced economies respectively. However, in the latter economies, other variables like inflation and exchange rates are no longer statistically significant.

Table 4-5. The Augmented Taylor Rule with Capital Inflows & GFC Dummy

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 3	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Lag Policy Rates	0.534***	0.525***	0.439***	0.432***	0.804***	0.807***	0.588***	0.590***	0.603***	0.599***	0.463***	0.459***
	(0.07)	(0.07)	(0.08)	(0.08)	(0.03)	(0.03)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.525***	0.477***	0.477***	0.408***	0.059	0.043	0.146	0.137	0.454***	0.428***	0.451***	0.418***
	(0.11)	(0.10)	(0.10)	(0.09)	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	2.143**	3.840***	-0.030	1.827	1.784**	1.984**	-0.154	-0.021	2.385***	3.356***	0.152	1.137
	(0.96)	(0.95)	(1.16)	(1.14)	(0.90)	(0.85)	(0.85)	(0.86)	(0.81)	(0.88)	(0.97)	(1.06)
REER Gap		-0.086***		-0.096***		-0.007		-0.005		-0.046***		-0.048***
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.022***	0.023***	0.024***	0.025***	0.048***	0.048***	0.036**	0.036**	0.031***	0.032***	0.029***	0.031***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.321***	0.311***			0.360***	0.359***			0.362***	0.364***
			(0.10)	(0.09)			(0.06)	(0.06)			(0.07)	(0.07)
VIX Index			0.088***	0.101***			-0.008	-0.009			0.050***	0.053***
			(0.02)	(0.02)			(0.01)	(0.01)			(0.02)	(0.02)
GFC Dummy	-1.506***	-1.314***	-1.950***	-1.883***	-1.885***	-1.908***	-0.905***	-0.918***	-1.617***	-1.606***	-1.480***	-1.493***
	(0.35)	(0.31)	(0.48)	(0.38)	(0.18)	(0.19)	(0.21)	(0.21)	(0.24)	(0.23)	(0.33)	(0.30)
Constant	2.454***	2.511***	1.032**	0.857	0.274***	0.261***	0.407**	0.405**	1.687***	1.697***	0.893***	0.843**
	(0.53)	(0.56)	(0.51)	(0.57)	(0.08)	(0.09)	(0.19)	(0.19)	(0.36)	(0.37)	(0.32)	(0.33)
Observations	302	302	302	302	177	177	177	177	479	479	479	479
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

Table 4-6. The Augmented Taylor Rule with Capital Inflows

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 3	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Lag Policy Rates	0.521***	0.514***	0.406***	0.401***	0.788***	0.786***	0.565***	0.565***	0.591***	0.587***	0.435***	0.431***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.470***	0.423***	0.468***	0.398***	-0.037	-0.023	0.135	0.134	0.394***	0.367***	0.444***	0.412***
	(0.12)	(0.11)	(0.11)	(0.10)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	1.991**	3.925***	-0.024	1.876	3.426***	3.248***	0.447	0.469	2.555***	3.573***	0.367	1.316
	(0.89)	(0.95)	(1.16)	(1.23)	(0.65)	(0.61)	(0.95)	(1.01)	(0.77)	(0.86)	(0.98)	(1.10)
REER Gap		-0.096***		-0.099***		0.006		-0.001		-0.049**		-0.047**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.023***	0.024***	0.020***	0.022***	0.031*	0.031*	0.026	0.026	0.029***	0.030***	0.024***	0.025***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.419***	0.405***			0.403***	0.403***			0.436***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.044**	0.058***			-0.025***	-0.025***			0.018	0.021
			(0.02)	(0.02)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.408***	2.475***	1.797***	1.588***	0.269***	0.280***	0.710***	0.710***	1.630***	1.641***	1.424***	1.381***
	(0.55)	(0.58)	(0.57)	(0.59)	(0.07)	(0.08)	(0.19)	(0.19)	(0.37)	(0.38)	(0.35)	(0.35)
Observations	302	302	302	302	177	177	177	177	479	479	479	479
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

4.5.2.3. Taylor Rule with a Threshold on Capital Inflows

In the literature, there have been extensive discussions on the nonlinear characteristics of the Taylor rule, which are evident from how the central bank's respond to the deviations of inflation and the output gap from their targets. As a consequence, this nonlinear behaviour might lead to different responses by the central banks to inflation and the output gap when there are different changes in economic conditions.

The estimation results in the previous section revealed the importance of international influences on policy rate setting for the IT countries. To explore further whether capital flows influence the behaviour of policymakers, the next set of models are estimated by setting a threshold on the capital inflows variable. Hence, this section particularly discusses the reaction of the central banks during high and low capital inflow periods. Following the conventional approach, this study sets the 10^{th} and 90^{th} percentile as the upper and lower band thresholds of the capital inflows which corresponds to the highest and lowest capital inflow value periods. Furthermore, a robustness check is applied by applying the 5^{th} and 95^{th} percentile thresholds. The threshold values of the capital flows are reported in Table A4-3 in the appendices.

As before, the augmented Taylor rule is estimated with a similar set of variables, only this time with the thresholds. At first, a set of new dummy variables is defined, taking the value of 1 for the observations above the upper band threshold and below the lower band threshold, and 0 otherwise. Next, the dummies are multiplied by the capital inflows values (which are stated in terms of the percentage ratio to GDP). This variable will be accommodated in the next set of regressions. The results, as shown in Table 4-7, are in line with the expectations. The foreign inflows, during the highest and lowest periods, are found to be statistically significant only in emerging economies, implying that for the central banks in advanced economies, this indicator is not as important as in emerging economies. The estimation outcomes for other variables exhibit comparable inferences to the previous estimations when no thresholds on capital inflows are applied. In line with the discussion in the previous section for the non-threshold models, here we can notice that model 8 appears to represent best the main interest of this study during extreme inflows episodes. In emerging economies, a 1% rise in capital inflows relative to GDP is responded by a 0.02% increase in the policy rates during the extreme inflows periods.

It is also interesting to examine how the central banks react to the foreign flows during normal periods, or in this case, when capital inflows are inside the threshold bands. To answer this question, this study constructs another dummy variable that is equal to 1 when capital inflows are between the 10^{th} and 90^{th} percentile, and 0 otherwise. Subsequently, this dummy is multiplied by the capital inflows to generate a new variable that corresponds to capital inflows within the threshold. The estimated results reported in Table 4-8 show that capital inflows, during normal periods, only matter to policy rate decision making in emerging economies. In this case, model 12 can be chosen as our main model for the same reason explained earlier. The significance of the estimated parameters of capital inflows is slightly different from the extreme inflows episodes, when the central banks in both emerging and advanced IT countries respond to capital inflows as in Table 4-8. A 1% increase in capital inflows relative to GDP could lead to a 0.02% and 0.03% rise in the policy rates in emerging and advanced economies respectively during normal periods. However, in this case, the response of the policymakers is stronger in emerging countries compared to advanced countries, as it is weakly significant at the 10% level. Based on these findings, we can conclude that capital inflows are a very important indicator for interest rates setting in emerging economies during normal and substantial capital inflows episodes. Whilst in advanced economies, the monetary policy authorities only react to capital inflows during extreme inflows periods and occasionally very weakly respond to the inflows throughout normal periods.

The possibility of policy rules being applied differently in some economies to others has also been discussed by Svensson (2000) who described that different characteristics between advanced and emerging economies could result in the need for different models. As an example, for the US economy, given its characteristic as a large and not very open economy, inflation and the output gap are considered to be very important indicators. In contrast, for a smaller and more open economy, other variables like the real exchange rate, term of trade, foreign output and foreign interest rates are also substantial concerns. Moreover, Taylor (2000) explained that the differences might depend on the diverse market conditions in developing economies. Compared to the policy rules in advanced economies with more developed financial markets, the emerging markets might need to modify their interest rate setting to one that is more appropriate to their development characteristics.

Table 4-7. Taylor Rule Estimation Results beyond the Capital Inflows Threshold Bands

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 7	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**
Lag Policy Rates	0.520***	0.512***	0.403***	0.398***	0.789***	0.787***	0.571***	0.571***	0.593***	0.588***	0.436***	0.432***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.469***	0.423***	0.468***	0.399***	-0.041	-0.028	0.126	0.123	0.391***	0.364***	0.443***	0.412***
	(0.12)	(0.11)	(0.11)	(0.10)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	2.042**	3.979***	0.030	1.921	3.671***	3.499***	0.850	0.883	2.535***	3.570***	0.362	1.320
	(0.89)	(0.95)	(1.17)	(1.24)	(0.56)	(0.52)	(0.94)	(0.98)	(0.76)	(0.85)	(0.97)	(1.09)
REER Gap		-0.096***		-0.098***		0.006		-0.001		-0.049**		-0.047**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.023**	0.022***	0.022**	0.022***	0.018	0.018	0.006	0.006	0.028***	0.030***	0.024***	0.026***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.421***	0.408***			0.401***	0.401***			0.435***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.043**	0.057***			-0.026***	-0.026***			0.018	0.020
			(0.02)	(0.02)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.515***	2.586***	1.906***	1.709***	0.445***	0.455***	0.886***	0.886***	1.747***	1.769***	1.537***	1.505***
	(0.55)	(0.58)	(0.56)	(0.60)	(0.11)	(0.11)	(0.23)	(0.23)	(0.37)	(0.38)	(0.35)	(0.36)
Observations	302	302	302	302	177	177	177	177	479	479	479	479
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the1% level of significance.

Table 4-8. Taylor Rule Estimation Results within the Capital Inflows Threshold Bands

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 11	**Model 12**	**Model 13**	**Model 14**	**Model 11**	**Model 12**	**Model 13**	**Model 14**	**Model 11**	**Model 12**	**Model 13**	**Model 14**
Lag Policy Rates	0.521***	0.514***	0.406***	0.401***	0.788***	0.786***	0.565***	0.565***	0.591***	0.587***	0.435***	0.431***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.470***	0.423***	0.468***	0.398***	-0.037	-0.023	0.135	0.134	0.394***	0.367***	0.444***	0.412***
	(0.12)	(0.11)	(0.11)	(0.10)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	1.991**	3.925***	-0.024	1.876	3.426***	3.248***	0.447	0.469	2.555***	3.573***	0.367	1.316
	(0.89)	(0.95)	(1.16)	(1.23)	(0.65)	(0.61)	(0.95)	(1.01)	(0.77)	(0.86)	(0.98)	(1.10)
REER Gap		-0.096***		-0.099***		0.006		-0.001		-0.049**		-0.047**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.023***	0.024***	0.020***	0.022***	0.031*	0.031*	0.026	0.026	0.029***	0.030***	0.024***	0.025***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.419***	0.405***			0.403***	0.403***			0.436***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.044**	0.058***			-0.025***	-0.025***			0.018	0.021
			(0.02)	(0.02)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.408***	2.475***	1.797***	1.588***	0.269***	0.280***	0.710***	0.710***	1.630***	1.641***	1.424***	1.381***
	(0.55)	(0.58)	(0.57)	(0.59)	(0.07)	(0.08)	(0.19)	(0.19)	(0.37)	(0.38)	(0.35)	(0.35)
Observations	302	302	302	302	177	177	177	177	479	479	479	479
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the1% level of significance.

4.5.2.4. Taylor Rule with No Threshold on Capital Outflows

The recent literature has emphasised the large movements of capital flows across countries, from advanced to emerging economies (Calvo et al. (1993), Ahmed and Zlate (2014), and Froyen and Guender (2018)). Massive cross-border capital flows especially occurred when the global financial crisis hit some of the most advanced countries around 2008-2009. As a receiver of capital inflows, emerging economies at that time gained significant benefits, despite all of the challenges that came with it. Preventing a capital flows reversal has been one of the challenges encountered by the receiving economies. Furthermore, managing capital outflows is equally important for the authorities in order to minimize the risk of a massive investment shrinkage in the domestic economy.

To complete the analysis, this section describes the results from the augmented Taylor rule using the capital outflows variable, in addition to the other added variables. The financial outflows data refers to the assets side of direct investment and portfolio investments and is taken from the Balance of Payments, which represents domestic ownership of foreign assets. The estimation outputs from these models implies almost similar findings to the ones from the Taylor rule with capital inflows. Table 4-9 and Table 4-10 report the estimations with and without controlling for the global financial crisis dummy variable. As before, the outcomes from the two tables are comparable, but we concentrate on the results in Table 4-9. Moreover, like in the previous discussions on capital inflows, we refer to model 4 that is in line with our main interest in this study, based on Taylor (2001). In this model, a 1% increase in capital outflows relative to GDP can be linked to a rise in the policy rates in emerging economies by 0.02% and in advanced economies by 0.04%. We can see that capital outflows are as important as capital inflows for monetary policy setting in emerging and advanced economies. The positive sign indicates that the central banks respond to the increasing capital outflows by raising interest rates. A possible explanation might be related to the central bank policy to curtail sudden increases in capital outflows from the domestic economy. As expected, the estimation results for the other variables in these models are analogous with the ones from the Taylor rule with capital inflows (Table 4-5).

Table 4-9. The Augmented Taylor Rule with Capital Outflows & GFC Dummy

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 3	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 5**	**Model 4**	**Model 6**	**Model 3**	**Model 5**	**Model 4**	**Model 6**
Lag Policy Rates	0.574***	0.559***	0.453***	0.441***	0.788***	0.791***	0.582***	0.584***	0.641***	0.633***	0.483***	0.477***
	(0.07)	(0.07)	(0.09)	(0.08)	(0.02)	(0.02)	(0.06)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)
Inflation Gap	0.483***	0.452***	0.450***	0.399***	0.071	0.057	0.153	0.143	0.402***	0.387***	0.419***	0.401***
	(0.13)	(0.12)	(0.12)	(0.10)	(0.08)	(0.08)	(0.10)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.722*	3.163***	-0.609	1.045	1.711*	1.896**	-0.017	0.110	1.956**	2.778***	-0.245	0.520
	(0.94)	(0.91)	(1.09)	(1.09)	(0.90)	(0.86)	(1.00)	(1.00)	(0.87)	(0.91)	(0.96)	(1.01)
REER Gap		-0.070***		-0.078***		-0.007		-0.004		-0.036***		-0.034**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.01)		(0.02)
Capital Outflows	0.024***	0.022***	0.023***	0.022***	0.039***	0.039***	0.026***	0.026***	0.035***	0.035***	0.027***	0.027***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.341***	0.331***			0.357***	0.356***			0.361***	0.363***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.07)
VIX Index			0.092***	0.102***			-0.012	-0.013			0.049***	0.051***
			(0.02)	(0.02)			(0.01)	(0.01)			(0.02)	(0.02)
GFC Dummy	-1.348***	-1.255***	-1.730***	-1.746***	-1.745***	-1.767***	-0.766***	-0.778***	-1.525***	-1.542***	-1.316***	-1.346***
	(0.32)	(0.31)	(0.42)	(0.37)	(0.15)	(0.15)	(0.20)	(0.20)	(0.22)	(0.22)	(0.30)	(0.29)
Constant	2.186***	2.283***	0.772*	0.679	0.390***	0.379***	0.579**	0.577**	1.488***	1.525***	0.754***	0.748**
	(0.47)	(0.52)	(0.46)	(0.52)	(0.08)	(0.09)	(0.24)	(0.24)	(0.31)	(0.32)	(0.27)	(0.29)
Observations	282	282	282	282	177	177	177	177	459	459	459	459
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

Table 4-10. The Augmented Taylor Rule with Capital Outflows

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 3	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Lag Policy Rates	0.552***	0.539***	0.411***	0.399***	0.766***	0.765***	0.561***	0.562***	0.620***	0.612***	0.449***	0.441***
	(0.08)	(0.07)	(0.09)	(0.08)	(0.02)	(0.02)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.453***	0.419***	0.464***	0.414***	-0.002	0.011	0.148	0.146	0.362***	0.349***	0.429***	0.414***
	(0.13)	(0.12)	(0.12)	(0.11)	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.460*	3.091***	-0.897	0.717	2.791***	2.620***	0.334	0.363	1.961**	2.753***	-0.270	0.403
	(0.84)	(0.86)	(0.99)	(1.07)	(0.94)	(0.83)	(1.04)	(1.08)	(0.81)	(0.84)	(0.90)	(0.95)
REER Gap		-0.077***		-0.077***		0.006		-0.001		-0.035**		-0.031*
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Outflows	0.021***	0.019***	0.018***	0.017***	0.044***	0.044***	0.025***	0.025***	0.035**	0.035**	0.024***	0.024***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.441***	0.433***			0.393***	0.393***			0.435***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.053***	0.063***			-0.026***	-0.026***			0.022*	0.023*
			(0.02)	(0.01)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.193***	2.293***	1.466***	1.382***	0.270**	0.280**	0.778***	0.778***	1.452***	1.491***	1.215***	1.222***
	(0.51)	(0.55)	(0.47)	(0.53)	(0.11)	(0.12)	(0.22)	(0.22)	(0.34)	(0.35)	(0.28)	(0.29)
Observations	282	282	282	282	177	177	177	177	459	459	459	459
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

4.5.2.5. Taylor Rule with Threshold on Capital Outflows

As before, similar thresholds are imposed for capital outflows using the 10^{th} and 90^{th} percentile, by generating dummy variables equal to 1 if the capital outflows are above the upper threshold and below the lower threshold. Otherwise, the dummy value is set to 0. Subsequently, this study generates a new variable which is the product of the dummy variable and the capital outflows, to be included in the estimation. Table 4-11 reports the estimated parameters and the standard errors of all variables included in the models. Consistent with the previous discussion, in this case, model 8 suits the augmented version of Taylor rule that is focused on capital outflows. The results suggest that a 1% rise in capital outflows relative to GDP could lead to a 0.02% and 0.03% increase in the policy rates in emerging and in advanced economies respectively. In this case, the central banks in both emerging and advanced economies consider the capital outflows as one of the main factors for their interest rate setting. We also notice that the magnitude and sign of the estimated parameter for all other variables are very close to the models without the thresholds in Table 4-9. It is interesting to note that the central banks in advanced economies do not put as much weight on capital inflows as the outflows, particularly during the extreme periods. If we compare the results from Table 4-7 (Taylor rule with a threshold on capital inflows) and Table 4-11 (Taylor rule with a threshold on capital outflows), there is a noticeable difference in the significance of the parameter estimates of capital outflows. Whilst the coefficient of capital outflows is always significant in all models, it is not the case for inflows. Thus, we can summarize that during the extreme periods, unlike the capital inflows, capital outflows are considered an important indicator for the central banks in advanced economies when determining interest rates. To see how the central banks react to the capital outflows during normal periods (when the amount of outflows are inside the threshold bands), another estimation is conducted and the results are presented in Table 4-12.

Again, the estimated coefficient on capital outflows in all economies are significant, as in previous estimations during extreme outflows episodes. This finding implies that when it comes to capital outflows, either during the extreme (highest and lowest) periods or during normal periods, the policymakers in both economies have consistently considered this indicator in their policy rate setting[18].

[18] As a robustness check, similar models are estimated by applying the 5th and 95th percentile as the lower and upper band for capital inflows and outflows variables. No significant changes are found in the estimation results from capital inflows and outflows during the extreme and normal periods. The signs and magnitudes of the estimated parameters of the capital inflows are very close to the previous results using the 10th and 90th percentile thresholds. These findings confirm the consistency of the models and thus support the conclusion regarding the importance of capital inflows for interest rate setting in emerging economies. Unlike emerging economies, the central banks in advanced economies show more concern on capital outflows when setting their interest rates.

Table 4-11. Taylor Rule Estimation Results beyond the Capital Outflows Threshold Bands

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 7	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**
Lag Policy Rates	0.552***	0.539***	0.410***	0.399***	0.784***	0.782***	0.571***	0.572***	0.619***	0.610***	0.448***	0.440***
	(0.08)	(0.07)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.451***	0.418***	0.462***	0.413***	-0.027	-0.014	0.129	0.126	0.360***	0.347***	0.428***	0.413***
	(0.13)	(0.12)	(0.12)	(0.11)	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.463*	3.090***	-0.912	0.701	3.218***	3.054***	0.757	0.793	1.944**	2.739***	-0.285	0.388
	(0.83)	(0.86)	(0.99)	(1.07)	(0.90)	(0.78)	(0.98)	(1.00)	(0.81)	(0.85)	(0.90)	(0.96)
REER Gap		-0.076***		-0.076***		0.006		-0.001		-0.036**		-0.032*
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Outflows	0.019***	0.017***	0.017***	0.015***	0.025***	0.025***	0.008**	0.008**	0.028***	0.029**	0.019***	0.020***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.443***	0.435***			0.398***	0.398***			0.437***	0.440***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.053***	0.062***			-0.027***	-0.027***			0.021*	0.023*
			(0.01)	(0.01)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.227***	2.323***	1.499***	1.413***	0.449***	0.459***	0.894***	0.894***	1.552***	1.592***	1.297***	1.302***
	(0.51)	(0.55)	(0.47)	(0.53)	(0.11)	(0.12)	(0.24)	(0.24)	(0.33)	(0.35)	(0.28)	(0.30)
Observations	282	282	282	282	177	177	177	177	459	459	459	459
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

Table 4-12. Taylor Rule Estimation Results within the Capital Outflows Threshold Bands

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 11	Model 12	Model 13	Model 14	Model 11	Model 12	Model 13	Model 14	Model 11	Model 12	Model 13	Model 14
Lag Policy Rates	0.552***	0.539***	0.411***	0.399***	0.766***	0.765***	0.561***	0.562***	0.620***	0.612***	0.449***	0.441***
	(0.08)	(0.07)	(0.09)	(0.08)	(0.02)	(0.02)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.453***	0.419***	0.464***	0.414***	-0.002	0.011	0.148	0.146	0.362***	0.349***	0.429***	0.414***
	(0.13)	(0.12)	(0.12)	(0.11)	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.460*	3.091***	-0.897	0.717	2.791***	2.620***	0.334	0.363	1.961**	2.753***	-0.270	0.403
	(0.84)	(0.86)	(0.99)	(1.07)	(0.94)	(0.83)	(1.04)	(1.08)	(0.81)	(0.84)	(0.90)	(0.95)
REER Gap		-0.077***		-0.077***		0.006		-0.001		-0.035**		-0.031*
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Outflows	0.021***	0.019***	0.018***	0.017***	0.044***	0.044***	0.025***	0.025***	0.035**	0.035**	0.024***	0.024***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.441***	0.433***			0.393***	0.393***			0.435***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.053***	0.063***			-0.026***	-0.026***			0.022*	0.023*
			(0.02)	(0.01)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.193***	2.293***	1.466***	1.382***	0.270**	0.280**	0.778***	0.778***	1.452***	1.491***	1.215***	1.222***
	(0.51)	(0.55)	(0.47)	(0.53)	(0.11)	(0.12)	(0.22)	(0.22)	(0.34)	(0.35)	(0.28)	(0.29)
Observations	282	282	282	282	177	177	177	177	459	459	459	459
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively. All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance. The chi-squared test indicates that the null hypothesis of all coefficients equal to zero is rejected at the 1% level of significance.

4.6. Bayesian Model Averaging (BMA) Estimation

4.6.1. The Principle of BMA

Once the possibility of including the capital flows variable in the extended policy rules is figured out, a further analysis is performed to explore how important the capital flows are compared to other indicators. This will require the use of the Bayesian Model Averaging (BMA) technique. Although this study has a limited number of variables, this method can help to explore the most important indicator that the policymakers should consider responding to.

One common problem that is often encountered by researchers when constructing a reliable model is uncertainty in choosing the combination of explanatory variables which can best describe the variation of the response variable. The questions include the set of variables needing to be modelled, should one add or reduce the number of regressors in the model, or how important are those variables. BMA is beneficial, particularly in the presence of model uncertainty. When there is a wide variety of influencing regressors, the BMA framework helps to build the best model by providing the average weight showing the most important variables. A higher weight is assigned to more important variables. Therefore, this approach does not suggest what the true model is but helps to choose a better model based on the likelihood. Since being introduced, BMA has become a popular alternative method in model selection.

Despite its advantages, BMA involves a computational complexity, due to a large number of possible models accommodated, particularly when the number of potential regressors (K) is extremely large. Therefore, implementing BMA in practice can be challenging as K increases. Luckily, this obstacle can be tackled by employing the Markov Chain Monte Carlo model composition algorithm (MC3 sampler), which will be explained further in the later section.

This section describes the Bayesian Model Averaging (BMA) procedure for the cross countries estimation by Zeugner (2012), Zeugner and Feldkircher (2015), and Hasan et al. (2018), which will be applied in our estimation. A brief discussion of this method starts with the BMA with the basic linear model structure below. Given the complexity of the model combination, the researchers typically consider a subset of models:

$$y = \alpha_\gamma + \beta_\gamma X_\gamma + \varepsilon \qquad \varepsilon \sim N(0, \sigma^2 I) \tag{4.12}$$

where:

y : dependent variable

α_γ : constant

X_γ : the matrix of explanatory variables

β_γ : the corresponding coefficients

ε : a vector of normally distributed IID error terms with variance σ^2

When there are large number of explanatory variables in matrix X, an issue may occur, leading to a question of which variables $X_\gamma \in \{X\}$ needs to include in the model. As mentioned earlier, the matrix X in equation (4.12) is often related to the question of how many independent variables should be involved and which are the most influential ones. In order to come up with the best model estimation, a general approach, as explained by Koop and Potter (2003), is applied by gradually eliminating the least significant regressors. Nevertheless, this practice is also associated with the risk of important variables being excluded, while there is no assurance of finding the true model. On the other hand, including all control variables at times is inefficient and unreasonable, specifically when the number of observations is limited. BMA can deal with this obstacle by estimating models based on the combination of all possible variables in $\{X\}$ and calculate the weighted average of the coefficients. The number of model variations from K variables (number of regressors) in matrix X will lead to 2^K models from 2^K possible variable combinations, thus $\gamma \in [1, 2^K]$. Following Bayes' rule, as also explained in Zeugner (2012) and Hasan et al. (2018), equation (4.13) below denotes the posterior density:

$$p(\beta|y,X) = \frac{p(y,X|\beta)\, p(\beta)}{p(y,X)} \tag{4.13}$$

where $p(\beta|y,X)$ is the posterior density, $p(y,X|\beta)$ is the marginal likelihood, $p(\beta)$ is the prior density, and $p(y,X)$ is the probability of the data. As previously stated, for K variables, the model combinations are M_γ for every $\gamma \in [1, 2^K]$. Applying Bayes' rule, the following equation determines the posterior probability, which is defined by two main components, the likelihood function and the prior density, where the M_γ depends on the parameter β_γ so that $p(\beta_\gamma|M_\gamma)$.

$$p(\beta_\gamma|M_\gamma,y,X) = \frac{p(y|\beta_\gamma,M_\gamma,X)\, p(\beta_\gamma|M_\gamma)}{p(y|M_\gamma,X)} \tag{4.14}$$

The weights for averaging model coefficients can be determined from the Posterior Model Probability (PMP) that is based on the Bayes' theorem:

$$p(M_\gamma|y,X) = \frac{p(y|M_\gamma,X)\,p(M_\gamma)}{p(y|X)} \tag{4.15}$$

where $p(M_\gamma|y,X)$ refers to the PMP, and $p(y|M_\gamma,X)$ is the probability of the data in y given model M_γ, $p(M_\gamma)$ is the prior model probability, which reflects the initial theoretical beliefs before looking at the data. In other words, since $p(M_\gamma)$ does not involve data, it reflects how likely we believe that M_γ is the right model, without any previous knowledge about the data. The last part of the equation, $p(y|X)$ represents the integrated likelihood. Since this denominator is assumed to be constant over all models, the PMP is directly proportional to the marginal likelihood and the prior probability.

$$p(M_\gamma|y,X) \propto p(y|M_\gamma,X)\,p(M_\gamma) \tag{4.16}$$

Setting the prior model probability to a uniform prior is a sensible choice, implying that $p(M_\gamma) \propto 1$. This prior has been a popular option in the case where there is a lack of prior knowledge. Besides specifying the model priors ($p(M_\gamma)$ in the model space, we also need to set the parameter priors (g in the parameter space) before obtaining the posterior distribution. Determining the priors is a crucial step in the BMA framework, since it significantly affect the posterior probabilities (Feldkircher and Zeugner, 2009).

As for the parameter prior, one of the most popular choices is Zellner's g prior. This prior assumes that the constant and error variance in equation (4.12) is evenly distributed, thus, $p(\alpha_\gamma) \propto 1$ and $p(\sigma) \propto \sigma^{-1}$. Furthermore, the formulation of the prior beliefs of the coefficient distribution is assumed to follow a normal distribution, with a specified mean and variance. Under this conservative assumption, the zero means reflects the lack of prior knowledge of the coefficients before seeing the data. The Zellner's g-prior suggests the distribution of the coefficients are dependent on the prior g:

$$\beta_\gamma|g \sim N(0, \sigma^2(g(X_\gamma' X_\gamma)^{-1}) \tag{4.17}$$

where $\sigma^2(g(X_\gamma' X_\gamma)^{-1}$ is the variance structure as defined by Zellner's g. In other words, equation (4.17) means that the coefficients are equal to zero, and the structure of the variance-covariance matrix is in line with the data X_γ. As previously explained by Feldkircher and Zeugner (2009), g determines the weight of the prior variance, which is

different from the variance of the observed data. The size of g suggests different implications. A small g indicates a small prior coefficient variance, which can further imply a strong belief for the researcher about the coefficients that are equal to zero. This is because when choosing a small g, the variance in the prior coefficient will be low, thus reducing the coefficient to zero. In other words, a smaller (conservative) g implies a more important prior. Conversely, when g is large, it infers that the researcher is very uncertain that the coefficients are indeed zero. As $g \rightarrow \infty$, the estimated coefficient β_γ will be close to β_γ from OLS estimation (Zeugner, 2012).

Following Zeugner (2012) and Hasan et al. (2018), the weighted posterior distribution of the coefficient, represented by $p(\beta|y,X)$, can be determined by incorporating the posterior model probability ($p(M_\gamma|y,X)$) from equation (4.16). The model weighted posterior distribution for any statistic, such as the coefficient of β (posterior mean) can be expressed as in the following equation:

$$p(\beta|y,X) = \sum_{\gamma=1}^{2^K} p\left(\beta_\gamma|M_\gamma,y,X\right) p\left(M_\gamma|y,X\right) \tag{4.18}$$

Next, by taking the expectation of equation (4.18), we can obtain the average coefficient as reflected in $E(\beta|y,X)$, and produce the following formulation:

$$E(\beta|y,X) = \sum_{\gamma=1}^{2^K} E\left(\beta_\gamma|M_\gamma,y,X\right) p\left(M_\gamma|y,X\right) \tag{4.19}$$

where $E\left(\beta_\gamma|M_\gamma,y,X\right)$ is the estimated coefficient of β_γ given the model M_γ. Furthermore, the selection of the prior g is influential in obtaining the posterior distribution of the coefficient, as described in the equation below:

$$E\left(\beta_\gamma|y,X,g,M_\gamma\right) = \frac{g}{1+g}\,\hat{\beta}_\gamma \tag{4.20}$$

Note that $\hat{\beta}_\gamma$ is the standard coefficient from the OLS estimation for model γ.

Zeugner and Feldkircher (2015) also describes the posterior covariance equations which are related to the expected coefficients above. Here we can notice that the posterior variance of β_γ is influenced by the choice of g.

$$Cov(\beta_\gamma|y, X, g, M_\gamma) = \frac{(y-\bar{y})'(y-\bar{y})}{N-3}\frac{g}{1+g}\,(1-\frac{g}{1+g}R_\gamma^2(X_\gamma'X_\gamma))^{-1} \qquad (4.21)$$

In the BMA, the prior framework results into a simple marginal likelihood $p(y|M_\gamma, X, g)$, which is connected to the R-squared. It also incorporates a size penalty factor adjusting for model size k_γ

$$p(y|M_\gamma, X, g) \propto (y-\bar{y})'(y-\bar{y})^{-\frac{N-1}{2}}(1+g)^{\frac{k_\gamma}{2}}(1-\frac{g}{1+g}\,R_\gamma^2)^{-\frac{N-1}{2}} \qquad (4.22)$$

where:

R_γ^2 : R-squared of model M_γ

k_γ : number of explanatory variables in the model γ

N : number of observations

$\bar{y}$: the mean of vector y

Finally, one of the most useful outputs from the BMA estimation is the finding of which variables should be incorporated in the model, based on their probability values. These values are reported in the posterior inclusion probability (PIP). Variables with the highest PIP are considered as robust regressors, which are expected to be closer to the true model. The PIP is measured as the sum of the posterior model probability for all models, including the variable k.

$$PIP = p(\beta_k \neq 0|y, X) = \sum_{\gamma=1}^{2^K} p(M_\gamma|\beta_k \neq 0, y, X) \qquad (4.23)$$

Furthermore, obtaining the posterior probabilities using large numbers of covariates in practice is sometimes difficult and even sometimes not feasible, because it involves a complexity due to the large size of the model combinations, or it is computationally difficult and time-consuming. To overcome this issue, the Markov Chain Monte Carlo (MCMC) samplers have been adopted in the BMA framework, by utilizing the Metropolis-Hastings algorithm. The MCMC sampler selects the most significant part of the posterior model distribution to get the best results or most likely models. Zeugner and Feldkircher (2015) explained how this algorithm works through an example: as a start, at step i, the current model M_i has a posterior model probability of $P(M_i|y, X)$. In the following steps,

at step $i+1$, a candidate model M_j is offered to replace M_i. In this case, the sampler will switch the model, from M_i to M_j, with the probability of:

$$p_{i,j} = \min\left(1, \frac{p(M_j|y,X)}{p(M_i|y,X)}\right) \tag{4.24}$$

If the model M_j is failed, then the next candidate model M_k will be compared with the current model M_i. However, if M_j is accepted, it will be positioned as the current model, replacing M_i and will compete with the next candidate model at the next step. As the number of iterations is growing, the number of reserved models will converge to the posterior model probability distribution $P(M_i|y,X)$. One of the popular alternative MCMC samplers (standard model sampler in the BMA framework) in proposing candidate models is the birth-death sampler. Here one of the potential regressors is randomly chosen. If this regressor is not included in the current model M_i then it will be incorporated into the next candidate model M_j in addition to a similar set of other variables as in the model M_i Similarly, if this chosen variable is already counted in model M_i the next model M_j will also comprise it. Finally, in order to get better candidate models with a high PMP, generally, the initial set of iterations will be omitted from the computation. This is known as the "burn-ins" when the marginal likelihoods are not in the maximum position.

4.6.2. Estimation Results

This section outlines the approach to determining which are the most significant indicators of the policy rule in the sample. This study follows the Bayesian Model Averaging (BMA) procedure for the cross countries estimation by Zeugner (2012). This cross-section method requires us to previously calculate the average values of the observations in each country included in the sample. A similar sample of 34 inflation targeting countries is used in the estimation (as listed in Table A4-1 in the appendices). Note that only 5 regressors are included in this estimation, as the global factors (the fed funds rate and VIX) do not vary across countries.

The estimation results from all samples are presented in Table 4-13[19].

Table 4-13. The Cross-Section BMA Estimation Results

All Countries			Emerging Countries			Advanced Countries		
	PIP	**Post Mean**		**PIP**	**Post Mean**		**PIP**	**Post Mean**
Inflation Gap	1.00	1.54	Inflation Gap	1.00	1.43	Inflation Gap	0.81	1.49
Capital Outflows	0.82	-0.25	Capital Outflows	0.64	-0.37	REER Gap	0.35	0.14
Capital Inflows	0.21	0.03	Capital Inflows	0.27	0.08	GDP Gap	0.34	-18.80
REER Gap	0.15	0.01	REER Gap	0.25	-0.10	Capital Outflows	0.27	-0.03
GDP Gap	0.14	-0.21	GDP Gap	0.18	-1.34	Capital Inflows	0.20	0.01

The PIP in the first column represents the posterior inclusion probabilities, which indicates the importance of variables in explaining the data. Thus, the PIP coefficients and sequences can provide suggestions on which indicator has the most important influence and how its role can be compared to other variables in the estimated models. Zeugner (2012) also explained that PIP is the sum of PMPs (posterior model probabilities) where a regressor was incorporated in the models. In the second column, the post mean presents the coefficients averaged over all models, including the models wherein the variable is not included, in this case, when the coefficient equals to zero.

The estimation results based on all countries sample suggests that inflation gap has been the most important indicator for the interest rate setting, shown by its comparatively large coefficient (PIP) relative to other variables. In other words, we notice that 100% of the posterior model mass lies on models that cover inflation. Surprisingly, with 82% of PIP,

[19] A standard rule of BMA framework as explained in Zeugner (2012) and (Hasan et al., 2018) is adopted in this section. The rule specifies a burn-ins of 50,000, which refers to the first set of iterations that will be omitted from the output computation. This procedure is performed to get better candidate models with a high PMP. The number of iterations is set to 100,000. The prior model probability is equal to the uniform prior, which is a sensible choice in the case where there is a lack of prior knowledge. Under the uniform model prior, the probability of incorporating an explanatory variable is assumed to be independent of including any other one. Furthermore, the parameter prior is set to the benchmark prior g-BRIC, which corresponds to g = max $\{N, K^2\}$. Lastly, a standard MCMC approach is chosen by selecting the birth-death sampler. Under this method, one of the potential regressors is randomly chosen.

capital outflows are the next most influential variable in the models. This indicates that capital outflows have been one of the major concerns for the policymakers in the samples. Following this variable is the capital inflows, although it has comparatively lower inclusion probabilities than inflation and capital outflows. Other variables like the REER gap and GDP gap seem to be less important in this result, as the results often include models where these coefficients are zero. The finding for the GDP gap in particular, will need a further discussion, as this has been one of the main indicators in the standard Taylor rule.

The next noteworthy query is to see whether these indicators have similar roles when we disaggregate the samples into emerging and advanced economies. The results in the adjacent tables indicates a different PIP for advanced economies, suggesting that the output from the aggregate sample is closer to the policy rules in emerging economies. However, a caveat that needs to be underlined when using this estimation approach in this study is the limited number of observations, particularly on the disaggregated samples, as this study is focusing on inflation targeting countries only.

Whilst the PIP for emerging economies are close to the all sample results, in advanced economies, a different role is suggested by each indicator, except for the inflation gap. Other variables in this sample category show relatively low inclusion probabilities. The results also suggest that the capital flow variables in advanced economies are not as important for the policymakers as in emerging economies. This finding supports the previous analysis from the dynamic panel model estimations, although the PIP of capital outflows is slightly below the capital inflows.

4.7. Conclusion

Taylor and Williams (2010) suggested that the exploration of alternative policy rules may need to involve the international linkages of monetary policy and economies. However, there are a limited number of papers that discuss the influence of international linkages on the rule, particularly the ones that considers capital flow dynamics explicitly in the model. When they are discussed, the literature has tended to focus on the indirect effect via exchange rate pass-through. Moreover, Taylor (2013a) indicated the need to consider a rule-based monetary policy, even though it serves as a general guideline for the policymakers. He implied that the recent phenomena of increasing capital flows and exchange rate volatility have been closely related to changes in policy orientation in some major advanced economies, when the rules-based policy shifted to unconventional monetary policy.

Motivated by this experience, this chapter aims to contribute to the current policy rule discussions by exploring a potential alternative model that considers the influence of capital flows as one of the policy objectives. Using an empirical approach, this study investigates whether the central banks should explicitly respond to capital flow dynamics. To fulfil this purpose, the interest rate setting behaviour of monetary policymakers in 34 Inflation Targeting (IT) countries over the period 1990-2018 is examined.

The analysis of the central bank's reaction to capital flow dynamics has been performed by setting 2 thresholds which correspond to the upper and lower bands of the capital flow values. This approach allows us to classify the observations into 2 capital flow episodes: the extreme periods (beyond the threshold values) and normal periods (within the threshold values).

Using the Arellano Bond estimator, the findings from the Taylor rule estimation can be summarized as follows. First, in the baseline model, this study found significant estimated parameters of the inflation and output gap, suggesting their substantial role in the policy rate setting in both emerging and advanced economies. The positive sign of the coefficients implies that an increase in the inflation and output gap is met by a rise in the central banks' policy rates. Second, in the non-threshold models, the results suggest that the interest rate setting in all IT countries are significantly influenced by both capital inflows and outflows. Third, focusing on the threshold models, different findings are obtained in the two economies. In emerging markets, the policymakers are responsive to both capital inflows and outflows. This response is evident during the extreme and normal capital flow periods. On the other side, in advanced economies, the central banks only respond to capital outflows during the same observation periods, both in extreme and normal episodes. No significant reaction is demonstrated by the monetary authorities to capital inflow dynamics.

The exploration using different approaches also suggests comparable estimation results. The posterior inclusion probabilities (PIP) from the Bayesian Model Averaging (BMA) implied that, beside the inflation gap, capital flows also emerge as one of the most important indicators in the alternative extended Taylor rules. Although constrained by the limited number of observations in this study, this approach can provide an early indication of the important role of capital flows, in particular for the policymakers in emerging economies.

Overall, the empirical results confirm a potential to involve capital flow dynamics in the monetary policy setting, as an alternative policy rule in emerging and advanced economies.

Chapter 5. Conclusion and Implication for Economic Policy

5.1. A Brief Summary of the Findings

Understanding the main causes of capital inflows is crucial to constructing an effective policy framework so that the unfavourable risks from volatile capital flows can be anticipated and well managed. To explore this issue, identification of relevant pull and push factors of capital inflows in emerging and advanced economies has been completed in the first empirical chapter of this thesis. While domestic factors appear to be more important for emerging economies, the results suggest that a wider set of indicators from global factors matter in attracting more inflows to advanced economies. Once the flows are disaggregated, the estimation results suggest that different types of flows are driven by diverse sets of indicators, indicating the importance of disaggregation. Nevertheless, there are also some common drivers across economies, such as financial market development for DI and PI flows, and VXO indicator for PI and OI.

Furthermore, it is also crucial for the policymakers to be aware of how the capital flows may impact the domestic economy, in particular during the sudden surges flows episodes. The challenges faced by the authorities might also depend on the characteristic of the flows, specifically from the more short-term type of flows. This consideration is essential in the era of financial globalization, where free capital mobility between countries is inevitable. Focusing the study on the case of Indonesia, which has been experiencing surges in capital flows, the next empirical chapter explores how these flows affect the economy. We found that there is spillover effect from the US and Japan to Indonesia's economy. In particular, a shock on capital flows in both countries can be associated with contemporaneous increase in Indonesia's capital flows. Additionally, under similar models (Indonesia-US and Indonesia-Japan SVAR models), a shock on Indonesia's capital flows is connected to a rise in domestic inflation and an appreciation in the Rupiah exchange rate.

Finally, the last empirical chapter investigates the possibility of capital flow dynamics being accommodated into the formal policy rule. To meet this objective, the earlier version of the augmented Taylor rule as in Taylor (2001) is extended by a capital flow variable. The estimation outputs suggested significant reactions of the central bank to capital flows dynamics, especially during periods of extreme flows. As in most of the literature, capital flows influence on interest rate setting has been explored via the exchange rates, this study provides an alternative view about the explicit role of capital flow dynamics for monetary policy setting, specifically during times of extreme flows.

5.2. Policy Implications

As has been widely documented, regardless of its benefits, large and volatile capital inflows potentially pose some challenges, in that it may carry a threat to the stability of the domestic economy. Despite the advantages, many countries, especially the emerging economies typically have a great concern about the sudden surges in capital inflows, as they are perceived to be temporary. With this characteristic, there is a big concern if the advanced economies decide to increase their interest rate to the normal rate. Moreover, Kawai and Takagi (2010) discussed that the vulnerability can be observed from three main risks: the macroeconomic risk, financial stability risk, and capital flow reversal risk. In the case of high and volatile capital inflows, the macroeconomic risk can be explained further by sharp exchange rate appreciation, the high rise of inflation, and rapid credit expansion. The financial stability risk can be associated with the increasing asset prices, the maturity and currency mismatch and the lower quality of assets. Moreover, capital flow reversals can bring significant risks to the international reserves, as well as severe currency depreciation, which can endanger the domestic economy.

Related to the policy challenges, the sudden surges can complicate macroeconomic management and create financial risks. For example, when the economy is overheating, relying only on the interest rate adjustment policy will be no longer be effective. When a country is experiencing surges in capital inflows, another policy instrument like foreign exchange intervention is typically implemented by the central banks to stabilize the exchange rate. In addition, some policymakers may adjust the reserve requirements for banks in order to absorb the excess liquidity from domestic money markets. These circumstances imply that capital flow management in a period of a surge in capital inflows sometimes needs to be applied in parallel with other policies.

In managing capital flows, each country may construct their policy mix using different approach. The IMF (2018) has highlighted the importance of the choice of the policies in a particular country may depend on some crucial aspects like the kind of capital inflows, the nature of economic vulnerabilities, the framework of monetary policy and the capacity of the financial institutions. In addition, Ostry et al., (2010) also discussed some factors that may affect the choice of policy mix: the state of the economy, the level of international reserves, the quality of prudential regulation, the scope to allow the currency to strengthen and the persistence of capital inflows. Regardless of the vary characteristics of the countries, the typical well-known policy tools cover fiscal policy, monetary policy,

exchange rate policy, foreign exchange market intervention, domestic prudential regulation and capital controls.

Nevertheless, to response to capital flow dynamics, the IMF (2018) recommended that the countries should apply suitable macroeconomic policies as the main strategy, and accompanied by other policies such as macroprudential policies and foreign exchange interventions when it is necessary. Moreover, under certain circumstances another policy like Capital Flow Measures (CFM) can also be implemented as part of broader policy response. In line with this, Taylor (2018) also discussed similar policy approach and highlighted that typical policy measures related to capital flows like the CFMs are mainly aimed to limit capital flows (for example through capital controls), whilst the macroprudential policy measures (MPMs) is designed to restrain the systemic vulnerabilities, which may come from capital flows or exchange rate shocks. ECB (2016) provided some examples of the CFMs which include (i) taxes on capital inflows, (ii) caps on foreign ownership of domestic assets, (iii) minimum holding period for capital inflows, and (iv) reserve requirements on liabilities of non-residents. Whilst MPMs may cover (i) caps on loan-to-value ratios, (ii) caps on debt-to-income ratios, (iii) countercyclical capital requirements, (iv) limits on maturity mismatch, (v) dynamic provisioning, and (vi) reserve requirements on domestic currency liabilities. Although both policies have different objectives, under some circumstances, they may use to respond to similar shocks (IMF, 2013).

As discussed above, capital control has been part of common policy approaches to deal with the surges in capital inflows. Taxes on capital inflows and quantitative limits on borrowing from abroad are some examples of this policy (ECB, 2016). A properly designed set of controls on capital inflows can be applied under some circumstances. This policy is typically implemented to complement other policies during transitory inflows surges periods, as a standard macroeconomic policies or prudential regulations may not be sufficient. This is because the effect of the temporary inflows surges on the exchange rate appreciation is most likely not permanent, whilst the impact on the tradable sector is usually more persistence. Ostry et al. (2010) suggested two important arguments for imposing capital controls: (i) to curb the appreciation of the exchange rate, and (ii) to restrain crisis vulnerability due to excessive foreign borrowing.

The empirical findings in Chapter 2 implied that at the aggregate level, capital inflows to emerging economies are mainly driven by the country-specific pull factors (such as financial market development, exchange rates and political risk) and only showed limited

connection with the push factors (global volatility). This result contrasts with the finding in advanced economies, where the influence of push factors is more dominant. Our finding calls for different policy implications in both economies. Policy responses in emerging economies for example, should be more focused on making their domestic economies more resilient to external shocks by deepening financial markets, improving the quality of financial institutions, as well as enhancing macroeconomic policies. In this case, as the inflows are mainly driven by the country-specific factors, imposing capital control may not be effective in these economies. On the contrary, when the role of the push factors is substantial as found in advanced countries, the policymakers may wish to concentrate more on strengthening their capability to withstand capital flows volatility, as those factors are outside of the control of policymakers. To reduce the volatility of the flows, cooperation of the policymakers across countries, as well as across international institutions needs to be enhanced.

Our discussion in Chapter 3 suggested how capital flows may affect macroeconomic condition in a small open economy like Indonesia. Experiencing several episodes of large capital flows, we observed some contemporaneous impacts, such as on the exchange rate appreciation. Notwithstanding this impact is typically desirable for an emerging country like Indonesia, it may undermine the tradable sector competitiveness, which can take place for longer period. Aside from the macroeconomic perspective, another risk concern is coming from the financial fragility point of view, where surges in capital flows may urge an excessive borrowing and foreign currency exposure. Given these risks raised from exchange rates appreciation, the policymaker in the first place need to consider whether there is a need to allow for the appreciation based on the fundamental value of the currency. In Indonesia, the volatile capital flows, as well as other factors like irrational behaviour of market players, the microstructure conditions of the market and offshore market influence have been some factors that influence the Rupiah exchange rates volatility, indicating that changes on the exchange rates value do not always reflect fundamental value Warjiyo (2013). To cope with this challenge, the exchange rates policy should be directed to stabilizing the exchange rate along its fundamental path, such as by foreign exchange intervention. Furthermore, another noteworthy finding is the contemporaneous effect of capital flows shock on domestic inflation. As one of the inflation-targeting countries, the central bank has been focusing on achieving domestic price stability. Under this framework, interest rate policy plays a crucial role as the main instrument to achieve the inflation target. Therefore, to minimize the inflationary pressure, when necessary, further steps involve an adjustment in the domestic interest rate. In addition, given the impact of

domestic aggregate flows shocks on domestic growth (in Indonesia-US and Indonesia-Japan models), the authorities also need to give more attention on the possibility of overheating of the economy in the longer term. In this case, relying only on an interest rate policy will no longer be sufficient, which justify the need of accommodating a set of policy mix, such as macroprudential policy and capital flows management when it is necessary, in parallel with the main macroeconomic policy. In addition, an investigation of the spillover effects of capital flow dynamics can also involve more countries in the same region. This can help the policymakers to get feedback about the impacts to be considered on their policy analysis. When any significant influences exist, the policy coordination in the region should be stronger in order to minimize the risk originating from the capital flow volatility, including the possibility of a sudden stop or capital flow reversal. This implication is aligned with Mercado and Park (2011) who suggested that regional factors play influential roles in determining the size and volatility of capital inflows, particularly in emerging economies. Moreover, it has called for the need for increasing regional economic cooperation and policy coordination, as it may be important to design a policy framework to deal with the volatile capital flows in the region. In our case, this policy implication is particularly important to deal with the spillover effect from capital flows shock in Japan, which leads to contemporaneous increase in Indonesia's capital flows.

Lastly, given the volatile nature of capital inflows, more attention should be given to structural reforms to attract less volatile type of flows like FDI, as suggested by IMF (2017). Compared to other flows, FDI is known as a more stable and long-term source of funding. Increasing more domestic savings could help the country by reducing the reliance on foreign capital. Enhancement of capital market development also could accommodate the shock from surges or capital flows reversal, so that the government bond market will be less vulnerable to the less volatile market.

Chapter 4 have provided evidence of the need to explore further whether the policymaker need to consider capital flow dynamics in their alternative policy rule. According to the IMF (2018), policies related to capital flow measures must be applied in particular conditions. Irrespective of the view that this strategy should not substitute for the adjustment required by the macroeconomy, it might be applied temporarily, as part of a broader policy reaction. This suggestion is in line with the policy implications from our extended Taylor rule, where it possibly serves as an alternative policy rule during the extreme capital flow periods.

Regardless of the policy implications discussed above, an interesting point of view was acknowledged by Stiglitz (2004) who specifically challenged the idea of capital market liberalization as suggested by the IMF. Capital market liberalization has potentially caused developing countries to face risks from interest rates and exchange rates, which are related to capital flows and that seem to move pro-cyclically. Stiglitz recommended that instead of liberalizing the capital markets, the IMF should support the countries in designing interventions in the capital markets which stabilize capital flows or assure that they move counter-cyclically. This will call for more attention on the underlying factors that cause failures in capital markets.

5.3. Limitations and Future Research

The findings suggested in this thesis are certainly conditional on the construction of the empirical models in each chapter, as well as the sample used and the observed periods. In Chapter 2, the data availability in early observation periods in a number of countries, for example, has become one of the obstacles for obtaining larger datasets. This issue is especially relevant when the objective of the study is to identify the main determinants of an economic phenomenon, in this case it is the surges capital inflows. To cover most possible important indicators, ideally, one should include a larger set of relevant variables that exist consistently within certain periods. Furthermore, in Chapter 3, the empirical evidence is obtained based on the restrictions imposed in the contemporaneous systems, which depends heavily on the assumption applied for a particular country. In addition, having a larger set of variables in this framework is still currently challenging, due to the required estimation time, which may arise from the combination of the number of equations, the length of observations, and the number of lags. This has been the main justification for accommodating only restricted variables in the two-country SVAR model, as it also involves more indicators from another country. Finally, in the last empirical chapter, one of the constraints is specifically related to the inflation target indicator, as this only focuses on the inflation targeting economies. So far, only 38 countries have formally implemented an inflation targeting framework according to the IMF. Out of them, 33 countries with available data are covered in the sample (in addition to the US). This limitation is particularly challenging when the focus is on the Taylor rule implementation in the disaggregated sample. For example, only 10 advanced countries are currently listed as inflation targeters. This restriction is also applied to the length of the observation period, because most countries started to implement the IT framework in the 2000s.

From the technical perspective, given these specific limitations, further research that explores a wider set of data, once they have become available, is worth considering, especially with the disaggregated samples, as in Chapter 2 and Chapter 4 in this thesis. Moreover, from another point of view in Chapter 3, future research could examine other identification assumptions by imposing different restrictions as an alternative strategy to identify the shocks in the SVAR approach. A future research agenda with a further policy coordination implication would be exploring the economic factors in the region, to see their spillover effects on the neighbouring countries' economy. This can be done by investigating the contribution of major investors or main trading partners in the same region. Chapter 3 has concentrated on the structural model for Indonesia, where the influence from major trading partners like the US and Japan is considered. In a future study, this model can be enhanced by considering the influence of more countries using a more recent framework, like the three-country or multiple-country SVAR model. The influence of countries from South East Asian region for example, will need to be considered too, as they have experienced capital reversal around the crisis period in 1997/98. Another possible future study related to the alternative Taylor rule could aim at exploring the non-linear or asymmetric relationship between the interest rate setting and capital flow volatility. Additionally, given different characteristic of each type of capital flows, a separate analysis could be performed for each flow component.

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Appendices

Appendix 1: Tables of Chapter 2

Table A2-1. List of Countries (Chapter 2)

Emerging Economies				Advanced Economies	
1	Argentina	34	Kyrgyz Republic	1	Australia
2	Armenia	35	Malaysia	2	Canada
3	Aruba	36	Mali	3	Cyprus
4	Bahrain	37	Mauritius	4	Denmark
5	Bangladesh	38	Mexico	5	Estonia
6	Barbados	39	Moldova	6	Finland
7	Belarus	40	Morocco	7	France
8	Belize	41	Namibia	8	Germany
9	Benin	42	Niger	9	Iceland
10	Botswana	43	Nigeria	10	Israel
11	Brazil	44	Oman	11	Italy
12	Bulgaria	45	Pakistan	12	Japan
13	Chile	46	Panama	13	Korea Republic
14	China	47	Peru	14	Latvia
15	Colombia	48	Philippines	15	Lithuania
16	Costa Rica	49	Poland	16	Malta
17	Croatia	50	Romania	17	Netherlands
18	Dominica	51	Russia	18	Norway
19	Dominican Republic	52	Senegal	19	Portugal
20	Ecuador	53	Seychelles	20	Singapore
21	Egypt	54	South Africa	21	Slovak Republic
22	El Salvador	55	Sri Lanka	22	Slovenia
23	Gabon	56	St. Kitts and Nevis	23	Spain
24	Grenada	57	St. Lucia	24	Sweden
25	Guatemala	58	St. Vincent and the Grenadines	25	Switzerland
26	Guyana	59	Thailand	26	United Kingdom
27	Hungary	60	Togo	27	United States
28	India	61	Tunisia		
29	Indonesia	62	Turkey		
30	Jamaica	63	Ukraine		
31	Kazakhstan	64	Uruguay		
32	Kenya	65	Venezuela		
33	Kuwait				

Table A2-2. Summary Statistics of Variables (Chapter 2)

Variable	Full Sample					Emerging					Advanced				
	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Capital Flows															
Direct Investment	2,317	4.26	5.98	-3.12	39.25	1,644	4.14	5.55	-3.12	39.25	673	4.57	6.90	-3.12	39.25
Portfolio Investment	2,183	1.76	3.41	-6.48	17.20	1,518	1.02	2.57	-6.48	17.20	665	3.45	4.37	-6.48	17.20
Other Investment	2,327	3.04	10.04	-36.64	64.61	1,654	2.24	8.71	-36.64	64.61	673	5.00	12.53	-36.64	64.61
Aggregate Investment	2,329	9.65	18.09	-31.16	131.69	1,656	7.99	16.21	-31.16	131.69	673	13.73	21.51	-31.16	131.69
Domestic (Pull) Factors															
Credit to Private Sectors	2,162	3.44	13.82	-42.70	63.03	1,559	3.69	14.79	-42.70	63.03	603	2.79	10.88	-42.70	63.03
Trade Openness	2,356	83.31	48.03	19.23	318.74	1,667	79.48	38.60	19.23	274.97	689	92.57	64.54	19.23	318.74
Domestic GDP Growth	2,157	3.44	4.05	-11.33	22.65	1,468	3.86	4.22	-11.33	22.65	689	2.57	3.53	-11.33	15.24
Financial Openness	2,290	0.46	1.53	-1.92	2.35	1,631	-0.02	1.41	-1.92	2.35	659	1.64	1.13	-1.21	2.35
Debt	1,907	53.59	32.44	0.00	220.56	1,273	51.18	30.84	0.00	203.36	634	58.42	34.97	3.66	220.56
Financial Development	2,392	0.37	0.22	0.00	0.88	1,690	0.27	0.13	0.00	0.70	702	0.61	0.20	0.00	0.88
REER	2,366	100.16	22.80	33.28	265.48	1,664	101.81	24.98	33.28	265.48	702	96.25	15.84	33.28	160.03
Real Interest Rates	1,816	6.81	9.83	-36.27	46.45	1,281	7.68	11.35	-36.27	46.45	535	4.74	3.66	-7.85	28.69
Political Risk	1,986	69.25	12.14	29.25	96.08	1,324	63.49	9.74	29.25	86.58	662	80.79	7.26	36.25	96.08
Global (Push) Factors															
Global Growth	2,392	3.35	1.29	-0.36	6.53	1,690	3.35	1.29	-0.36	6.53	702	3.35	1.29	-0.36	6.53
US Government Bond	2,392	4.85	1.80	1.80	8.55	1,690	4.85	1.80	1.80	8.55	702	4.85	1.80	1.80	8.55
VXO	2,392	20.36	6.39	11.87	33.42	1,690	20.36	6.39	11.87	33.42	702	20.36	6.40	11.87	33.42
Money Growth	2,392	4.61	1.65	0.12	8.00	1,690	4.61	1.65	0.12	8.00	702	4.61	1.65	0.12	8.00

Table A2-3. Joint Significance Test Results for the Eliminated Variables

	Full Sample		Emerging Economies		Advanced Economies	
Direct Investment	Debt Real Interest Rates US Government Bond Money Growth	0.608	Debt Real Interest Rates US Government Bond Money Growth	0.916	Debt Real Interest Rates US Government Bond Money Growth	0.145
Portfolio Investment	Credit to Private Sectors Domestic GDP Growth REER Global Growth Money Growth	0.450	Credit to Private Sectors Domestic GDP Growth REER Global Growth Money Growth	0.124	Credit to Private Sectors Domestic GDP Growth REER Global Growth Money Growth	0.642
Other Investment	Credit to Private Sectors Real Interest Rates Political Risk Global Growth US Government Bond	0.136	Credit to Private Sectors Real Interest Rates US Government Bond Money Growth	0.135	Financial Development Real Interest Rates US Government Bond	0.477

Notes: The Prob > F (F-test for FE model) and Prob > χ^2 (Wald χ^2 test for RE model) that are higher than 0.05 indicate that we fail to reject the null hypothesis of the coefficients to be jointly significant.

Table A2-4. OLS, FE & RE Estimation Results - Direct Investment

		Full Sample			Emerging Economies			Advanced Economies		
		OLS	**FE *)**	**RE**	**OLS**	**FE**	**RE *)**	**OLS**	**FE**	**RE *)**
Domestic (Pull) Factors	Credit to Private Sectors	0.024	0.020	0.024	0.018	0.019	0.018	0.027	0.025	0.027
		(0.016)	(0.017)	(0.016)	(0.012)	(0.013)	(0.012)	(0.037)	(0.039)	(0.037)
	Trade Openness	0.051***	0.039*	0.051***	0.025*	0.030*	0.025*	0.071**	0.063***	0.071**
		(0.013)	(0.022)	(0.013)	(0.013)	(0.017)	(0.013)	(0.028)	(0.021)	(0.028)
	Domestic GDP Growth	-0.035	-0.021	-0.035	-0.077	-0.071	-0.077	0.031	0.031	0.031
		(0.080)	(0.074)	(0.080)	(0.092)	(0.086)	(0.092)	(0.149)	(0.133)	(0.149)
	Financial Openness	0.474	0.665	0.474	0.316*	0.300	0.316*	1.328	1.755	1.328
		(0.339)	(0.495)	(0.339)	(0.172)	(0.200)	(0.172)	(1.395)	(1.705)	(1.395)
	Debt	-0.006	0.001	-0.006	0.013	0.017	0.013	-0.020	-0.019	-0.020
		(0.012)	(0.021)	(0.012)	(0.024)	(0.032)	(0.024)	(0.024)	(0.031)	(0.024)
	Financial Development	4.410	8.845*	4.410	3.057	3.098	3.057	9.128	13.402*	9.128
		(2.891)	(4.698)	(2.891)	(3.504)	(4.549)	(3.504)	(6.965)	(7.428)	(6.965)
	REER	0.021**	0.019	0.021**	0.015*	0.019*	0.015*	0.038	0.044	0.038
		(0.009)	(0.012)	(0.009)	(0.008)	(0.011)	(0.008)	(0.026)	(0.030)	(0.026)
	Real Interest Rates	0.003	-0.003	0.003	-0.017	-0.021	-0.017	-0.017	0.027	-0.017
		(0.023)	(0.026)	(0.023)	(0.021)	(0.021)	(0.021)	(0.093)	(0.087)	(0.093)
	Political Risk	0.012	0.014	0.012	0.074	0.066	0.074	-0.042	-0.138	-0.042
		(0.032)	(0.043)	(0.032)	(0.048)	(0.053)	(0.048)	(0.093)	(0.123)	(0.093)
Global (Push) Factors	Global Growth	0.236**	0.188*	0.236**	-0.045	-0.054	-0.045	0.556*	0.549	0.556*
		(0.110)	(0.107)	(0.110)	(0.069)	(0.073)	(0.069)	(0.334)	(0.360)	(0.334)
	US Government Bond	0.363*	0.261	0.363*	-0.097	-0.089	-0.097	0.550*	0.424	0.550*
		(0.188)	(0.212)	(0.188)	(0.257)	(0.259)	(0.257)	(0.304)	(0.324)	(0.304)
	VXO	-0.015	-0.026	-0.015	-0.067**	-0.065**	-0.067**	0.008	0.008	0.008
		(0.023)	(0.026)	(0.023)	(0.030)	(0.029)	(0.030)	(0.059)	(0.065)	(0.059)
	Money Growth	0.116	0.147	0.116	-0.034	-0.020	-0.034	0.191	0.240	0.191
		(0.139)	(0.129)	(0.139)	(0.189)	(0.181)	(0.189)	(0.160)	(0.147)	(0.160)
	Dummy GFC	2.341***	2.056**	2.341***	2.733***	2.658**	2.733***	2.590*	2.061	2.590*
		(0.812)	(0.776)	(0.812)	(1.057)	(1.056)	(1.057)	(1.411)	(1.291)	(1.411)
	Constant	-6.039***	-7.305*	-6.039***	-4.344	-4.983	-4.344	-5.166	-1.523	-5.166
		(2.201)	(3.956)	(2.201)	(3.030)	(4.552)	(3.030)	(8.634)	(10.697)	(8.634)
	Observations	1098	1098	1098	680	680	680	418	418	418

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; *) the recommended results from Hausman test & BP LM test; standard errors are obtained based on the robust variance estimator.

Table A2-5. OLS, FE & RE Estimation Results - Portfolio Investment

		Full Sample			Emerging Economies			Advanced Economies		
		OLS	**FE *)**	**RE**	**OLS**	**FE**	**RE *)**	**OLS**	**FE *)**	**RE**
Domestic (Pull) Factors	Credit to Private Sectors	0.017	0.013	0.017	0.012	0.011	0.012	0.018	0.010	0.018
		(0.013)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)	(0.035)	(0.036)	(0.035)
	Domestic GDP Growth	-0.042	-0.027	-0.042	-0.009	-0.007	-0.009	-0.149	-0.113	-0.149
		(0.036)	(0.034)	(0.036)	(0.024)	(0.021)	(0.024)	(0.114)	(0.100)	(0.114)
	Financial Openness	0.200	0.176	0.200	-0.011	-0.144	-0.011	0.517*	1.062**	0.517*
		(0.129)	(0.245)	(0.129)	(0.132)	(0.188)	(0.132)	(0.275)	(0.434)	(0.275)
	Debt	-0.016**	-0.038**	-0.016**	-0.009	-0.024**	-0.009	-0.028**	-0.063**	-0.028**
		(0.007)	(0.015)	(0.007)	(0.008)	(0.011)	(0.008)	(0.013)	(0.029)	(0.013)
	Financial Development	5.684***	10.029***	5.684***	3.106**	5.288	3.106**	7.967***	14.413**	7.967***
		(1.594)	(2.940)	(1.594)	(1.244)	(3.182)	(1.244)	(2.991)	(5.220)	(2.991)
	REER	0.002	-0.005	0.002	0.006*	0.002	0.006*	-0.008	-0.009	-0.008
		(0.004)	(0.006)	(0.004)	(0.003)	(0.006)	(0.003)	(0.024)	(0.023)	(0.024)
	Real Interest Rates	0.001	-0.004	0.001	-0.000	-0.005	-0.000	0.031	0.064	0.031
		(0.014)	(0.018)	(0.014)	(0.011)	(0.014)	(0.011)	(0.113)	(0.093)	(0.113)
	Political Risk	0.024	0.029	0.024	0.050**	0.060*	0.050**	0.027	-0.058	0.027
		(0.018)	(0.032)	(0.018)	(0.020)	(0.031)	(0.020)	(0.048)	(0.077)	(0.048)
Global (Push) Factors	Global Growth	0.113	0.066	0.113	0.033	0.026	0.033	0.187	0.077	0.187
		(0.079)	(0.072)	(0.079)	(0.078)	(0.075)	(0.078)	(0.184)	(0.191)	(0.184)
	US Government Bond	0.072	-0.009	0.072	0.041	0.011	0.041	0.079	-0.097	0.079
		(0.240)	(0.250)	(0.240)	(0.191)	(0.197)	(0.191)	(0.498)	(0.542)	(0.498)
	VXO	-0.061***	-0.069***	-0.061***	-0.072***	-0.071***	-0.072***	-0.085**	-0.097**	-0.085**
		(0.016)	(0.017)	(0.016)	(0.014)	(0.013)	(0.014)	(0.042)	(0.046)	(0.042)
	Money Growth	0.056	0.072	0.056	-0.045	-0.020	-0.045	0.156	0.118	0.156
		(0.070)	(0.070)	(0.070)	(0.061)	(0.061)	(0.061)	(0.110)	(0.115)	(0.110)
	Dummy GFC	-1.039**	-1.498**	-1.039**	-0.464	-0.754	-0.464	-1.549*	-2.309**	-1.549*
		(0.511)	(0.600)	(0.511)	(0.449)	(0.458)	(0.449)	(0.871)	(0.990)	(0.871)
	Constant	-1.085	-1.360	-1.085	-1.717	-2.080	-1.717	-1.624	3.018	-1.624
		(1.123)	(2.085)	(1.123)	(1.275)	(2.498)	(1.275)	(4.785)	(5.160)	(4.785)
	Observations	1080	1080	1080	662	662	662	418	418	418

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; *) the recommended results from Hausman test & BP LM test; standard errors are obtained based on the robust variance estimator.

Table A2-6. OLS, FE & RE Estimation Results - Other Investment

		Full Sample			Emerging Economies			Advanced Economies		
		OLS	**FE**	**RE *)**	**OLS**	**FE**	**RE *)**	**OLS**	**FE**	**RE *)**
Domestic (Pull) Factors	Credit to Private Sectors	0.033	0.019	0.033	0.015	0.001	0.015	0.092**	0.082*	0.092**
		(0.026)	(0.029)	(0.026)	(0.030)	(0.033)	(0.030)	(0.040)	(0.045)	(0.040)
	Domestic GDP Growth	0.317**	0.350**	0.317**	0.118	0.183	0.118	0.807**	0.798**	0.807**
		(0.145)	(0.145)	(0.145)	(0.108)	(0.111)	(0.108)	(0.346)	(0.325)	(0.346)
	Financial Openness	0.449**	0.226	0.449**	0.396	-0.339	0.396	0.695	1.228	0.695
		(0.227)	(0.469)	(0.227)	(0.247)	(0.379)	(0.247)	(0.690)	(1.125)	(0.690)
	Debt	-0.031	-0.067*	-0.031	-0.014	-0.042	-0.014	-0.033	-0.052	-0.033
		(0.021)	(0.038)	(0.021)	(0.020)	(0.033)	(0.020)	(0.039)	(0.068)	(0.039)
	Financial Development	6.952*	16.357**	6.952*	2.816	13.764	2.816	2.440	7.354	2.440
		(4.051)	(7.188)	(4.051)	(5.728)	(11.425)	(5.728)	(10.046)	(11.935)	(10.046)
	REER	0.044*	0.036	0.044*	0.020	0.025	0.020	0.120*	0.108	0.120*
		(0.027)	(0.024)	(0.027)	(0.017)	(0.018)	(0.017)	(0.073)	(0.080)	(0.073)
	Real Interest Rates	-0.089	-0.066	-0.089	-0.094**	-0.097*	-0.094**	-0.053	0.048	-0.053
		(0.057)	(0.074)	(0.057)	(0.046)	(0.058)	(0.046)	(0.322)	(0.362)	(0.322)
	Political Risk	0.075	-0.011	0.075	0.020	-0.047	0.020	0.392*	0.352	0.392*
		(0.075)	(0.085)	(0.075)	(0.053)	(0.078)	(0.053)	(0.217)	(0.243)	(0.217)
Global (Push) Factors	Global Growth	0.295	0.233	0.295	-0.343	-0.371	-0.343	1.180*	1.087	1.180*
		(0.316)	(0.326)	(0.316)	(0.295)	(0.303)	(0.295)	(0.663)	(0.735)	(0.663)
	US Government Bond	1.396*	1.231	1.396*	1.424	1.378	1.424	0.960	0.811	0.960
		(0.763)	(0.754)	(0.763)	(1.208)	(1.185)	(1.208)	(0.752)	(0.770)	(0.752)
	VXO	-0.121***	-0.138***	-0.121***	-0.119**	-0.108**	-0.119**	-0.259**	-0.287**	-0.259**
		(0.042)	(0.048)	(0.042)	(0.047)	(0.047)	(0.047)	(0.103)	(0.132)	(0.103)
	Money Growth	0.817***	0.867***	0.817***	0.268	0.421	0.268	1.359***	1.331***	1.359***
		(0.315)	(0.295)	(0.315)	(0.400)	(0.402)	(0.400)	(0.426)	(0.439)	(0.426)
	Dummy GFC	3.438**	2.678**	3.438**	3.990**	2.925*	3.990**	5.789*	5.436*	5.789*
		(1.488)	(1.304)	(1.488)	(1.866)	(1.696)	(1.866)	(3.099)	(2.892)	(3.099)
	Constant	-11.104*	-6.062	-11.104*	0.970	2.003	0.970	-46.398**	-43.938*	-46.398**
		(6.637)	(8.336)	(6.637)	(5.031)	(9.974)	(5.031)	(19.426)	(24.126)	(19.426)
	Observations	1097	1097	1097	679	679	679	418	418	418

Notes: Standard errors in parentheses; * p < 0.10; ** p < 0.05; ***p < 0.01; *) the recommended results from Hausman test & BP LM test; standard errors are obtained based on the robust variance estimator.

Table A2-7. Breusch and Pagan Lagrangian Multiplier Test for Random Effects

Sample	Flows Type	$\bar{\chi}^2$	$Prob > \bar{\chi}^2$
Full Sample	Other Investment	258.20	0.00
Emerging Economies	Direct Investment	591.23	0.00
	Portfolio Investment	92.32	0.00
	Other Investment	25.55	0.00
	Aggregate Investment	437.65	0.00
Advanced Economies	Direct Investment	746.34	0.00
	Other Investment	213.11	0.00

Notes: $H0: \sigma^2(\mu) = 0$

Appendix 2: Tables and Figures of Chapter 3

Table A3-1. Summary Statistics of the SVAR Indicators, 1990q1-2016q4 (Chapter 3)

Variable	Variable Name	Unit	Obs	Mean	Std. Dev.	Min	Max
Indonesia Capital Flows Block							
Indonesia Total Netflows	ICF	% of GDP	108	0.35	0.62	-0.94	1.64
Indonesia Direct & Portfolio Investment Netflows	IDPI	% of GDP	108	0.43	0.51	-0.73	1.49
Indonesia Other Investment Netflows	IOI	% of GDP	108	-0.08	0.31	-0.76	0.66
Indonesia Domestic Block							
Export Growth	IEX	%	108	15.75	54.89	-99.99	308.11
Real GDP Growth	IGDP	%	105	5.02	4.29	-17.93	10.74
Inflation Rate	IINF	%	108	10.03	11.91	-0.59	78.40
Domestic Money Market Interest Rate	IINT	%	108	12.13	12.20	3.83	74.18
Credit to Private Non-Financial Sector Growth	ICRE	%	108	2.44	16.54	-71.19	43.10
Nominal Exchange Rates Growth	IER	%	108	2.59	14.86	-35.45	135.50
Global Block							
Global Commodity Price Growth	ICP	%	108	2.22	16.78	-35.73	44.70
World Output Growth	WGDP	%	108	2.22	1.51	-4.74	4.86
Global Money Market Interest Rate	MRATE	%	108	2.90	2.48	0.17	10.24
US Capital Flows Block							
US Total Netflows	UCF	% of GDP	108	2.74	1.59	0.61	6.29
US Direct & Portfolio Investment Netflows	UDIPI	% of GDP	108	1.93	1.80	-1.16	5.93
US Other Investment Netflows	UOI	% of GDP	108	0.81	0.91	-1.26	2.92
US Domestic Block							
US GDP	UGDP	%	108	2.47	1.74	-3.92	5.30
US Inflation Rate	UINF	%	108	2.49	1.29	-1.62	6.22
US Money Market Interest Rate	UINT	%	108	3.04	2.45	0.07	8.25

Table A3-2. Summary Statistics of the SVAR Indicators, 1996q1-2016q4 (Chapter 3)

Variable	Variable Name	Unit	Obs	Mean	Std. Dev.	Min	Max
Indonesia Capital Flows Block							
Indonesia Total Netflows	ICF	% of GDP	84	0.27	0.68	-0.94	1.64
Indonesia Direct & Portfolio Investment Netflows	IDPI	% of GDP	84	0.46	0.57	-0.73	1.49
Indonesia Other Investment Netflows	IOI	% of GDP	84	-0.19	0.25	-0.76	0.33
Indonesia Domestic Block							
Real GDP Growth	IGDP	%	84	4.32	4.46	-17.93	10.39
Inflation Rate	IINF	%	84	10.39	13.48	-0.59	78.40
Domestic Money Market Interest Rate	IINT	%	84	12.13	13.74	3.83	74.18
Nominal Exchange Rates Growth	IER	%	84	3.03	16.85	-35.45	135.50
Japan Capital Flows Block							
Japan Total Netflows	JCF	% of GDP	84	-1.98	2.10	-6.10	4.79
Japan Direct & Portfolio Investment Netflows	JDIPI	% of GDP	84	-2.25	2.86	-11.91	2.74
Japan Other Investment Netflows	JOI	% of GDP	84	0.27	2.74	-5.26	8.05
Japan Domestic Block							
Japan GDP	JGDP	%	84	0.85	2.17	-8.59	5.51
Japan Inflation Rate	JINF	%	84	0.12	1.06	-2.21	3.60
Japan Money Market Interest Rate	JINT	%	84	0.15	0.18	-0.05	0.51
Japan Nominal Exchange Rates Growth	JER	%	84	0.19	4.55	-14.38	13.58

Table A3-3. The Estimation Results: Indonesia SVAR Model (1990q1-2016q4)

Variable Name	Coef	SE	z	p>|z|	95% CI	
Total Netflows						
IGDP	-0.88	0.64	-1.38	0.17	-2.14	0.37
IINF	-1.70	1.00	-1.70	0.09	-3.66	0.26
IINT	1.56	1.83	0.85	0.39	-2.03	5.15
ICRE	3.29	1.83	1.79	0.07	-0.30	6.88
IER	6.07	2.56	2.37	0.02	1.04	11.09
Direct & Portfolio Investment Flows						
IGDP	-1.02	0.88	-1.17	0.24	-2.74	0.70
IINF	-2.24	1.33	-1.68	0.09	-4.86	0.37
IINT	0.75	2.60	0.29	0.77	-4.33	5.84
ICRE	7.45	2.54	2.93	0.00	2.47	12.44
IER	8.99	3.65	2.47	0.01	1.84	16.14
Other Investment Flows						
IGDP	-1.22	0.94	-1.29	0.20	-3.06	0.63
IINF	0.25	1.48	0.17	0.86	-2.64	3.15
IINT	1.27	2.71	0.47	0.64	-4.05	6.59
ICRE	0.63	2.84	0.22	0.82	-4.94	6.21
IER	3.62	4.01	0.90	0.37	-4.25	11.49

Notes:
- This VAR model satisfies the stability condition as all of the eigenvalues lie inside the unit circle.
- Since the off-diagonal components in the A matrix comprise the negative values of actual contemporaneous effects, the estimated coefficients are interpreted on the opposite sign.

Table A3-4. The Estimation Results: Indonesia-US SVAR Model (1990q1-2016q4)

Variable Name	Coef	SE	z	p>|z|	95% CI	
Total Netflows						
ICF	-0.05	0.03	-1.44	0.15	-0.12	0.02
IER	-1.94	1.56	-1.25	0.21	-5.00	1.12
IGDP	-2.08	0.77	-2.72	0.01	-3.59	-0.58
IINF	-2.18	1.12	-1.94	0.05	-4.38	0.02
IIR	1.54	2.43	0.63	0.53	-3.22	6.29
IER	11.42	4.55	2.51	0.01	2.51	20.33
Direct & Portfolio Investment Flows						
ICF	-0.05	0.02	-2.21	0.03	-0.09	-0.01
IER	-1.96	1.20	-1.64	0.10	-4.31	0.38
IGDP	-2.00	0.96	-2.09	0.04	-3.87	-0.13
IINF	-2.93	1.44	-2.03	0.04	-5.75	-0.10
IIR	-1.52	3.10	-0.49	0.62	-7.60	4.55
IER	25.56	5.56	4.60	0.00	14.68	36.45
Other Investment Flows						
ICF	-0.04	0.03	-1.40	0.16	-0.09	0.02
IER	-0.80	1.52	-0.53	0.60	-3.77	2.17
IGDP	-0.33	1.02	-0.33	0.74	-2.33	1.66
IINF	2.21	1.44	1.53	0.13	-0.62	5.04
IIR	-0.32	2.88	-0.11	0.91	-5.97	5.33
IER	-9.32	5.38	-1.73	0.08	-19.87	1.24

Notes:

- This VAR model satisfies the stability condition as all of the eigenvalues lie inside the unit circle.
- Since the off-diagonal components in the A matrix comprise the negative values of actual contemporaneous effects, the estimated coefficients are interpreted on the opposite sign.

Table A3-5. The Estimation Results: Indonesia-Japan SVAR Model (1996q1-2016q4)

Variable Name	Coef	SE	z	p>|z|	95% CI	
Total Netflows						
ICF	0.01	0.02	0.51	0.61	-0.03	0.06
IER	-0.79	0.76	-1.04	0.30	-2.28	0.70
IGDP	-1.31	0.39	-3.35	0.00	-2.08	-0.54
IINF	-1.09	1.04	-1.04	0.30	-3.13	0.95
IIR	2.22	2.08	1.07	0.29	-1.86	6.31
IER	9.89	3.59	2.76	0.01	2.86	16.92
Direct & Portfolio Investment Flows						
ICF	-0.02	0.01	-1.81	0.07	-0.05	0.00
IER	0.50	0.60	0.82	0.41	-0.69	1.68
IGDP	-0.62	0.53	-1.16	0.25	-1.67	0.43
IINF	-1.17	1.56	-0.75	0.45	-4.23	1.89
IIR	-0.41	2.65	-0.15	0.88	-5.61	4.79
IER	11.84	4.63	2.56	0.01	2.76	20.92
Other Investment Flows						
ICF	0.02	0.01	1.81	0.07	0.00	0.03
IER	-0.66	0.63	-1.04	0.30	-1.90	0.58
IGDP	-1.13	0.85	-1.33	0.18	-2.79	0.54
IINF	-4.20	1.95	-2.15	0.03	-8.03	-0.37
IIR	4.48	3.69	1.21	0.23	-2.75	11.71
IER	-2.24	7.41	-0.30	0.76	-16.76	12.29

Notes:

- This VAR model satisfies the stability condition as all of the eigenvalues lie inside the unit circle.
- Since the off-diagonal components in the A matrix comprise the negative values of actual contemporaneous effects, the estimated coefficients are interpreted on the opposite sign.

Table A3-6. Joint Significance Test Results for the SVAR Models (Chapter 3)

Two-Country SVAR Model: Indonesia-US, 1990-2016

Equation	χ^2	Prob>χ^2
Aggregate Investment Flows		
Aggregate Investment Flows	170.35	0.00
GDP Growth	316.63	0.00
Inflation	475.91	0.00
Interest Rates	135.44	0.00
Exchange Rates	351.77	0.00
Direct & Portfolio Investment Flows		
Direct & Portfolio Investment Flows	155.21	0.00
GDP Growth	348.21	0.00
Inflation	469.41	0.00
Interest Rates	125.39	0.00
Exchange Rates	329.50	0.00
Other Investment Flows		
Other Investment Flows	61.83	0.01
GDP Growth	326.61	0.00
Inflation	470.77	0.00
Interest Rates	146.90	0.00
Exchange Rates	434.36	0.00

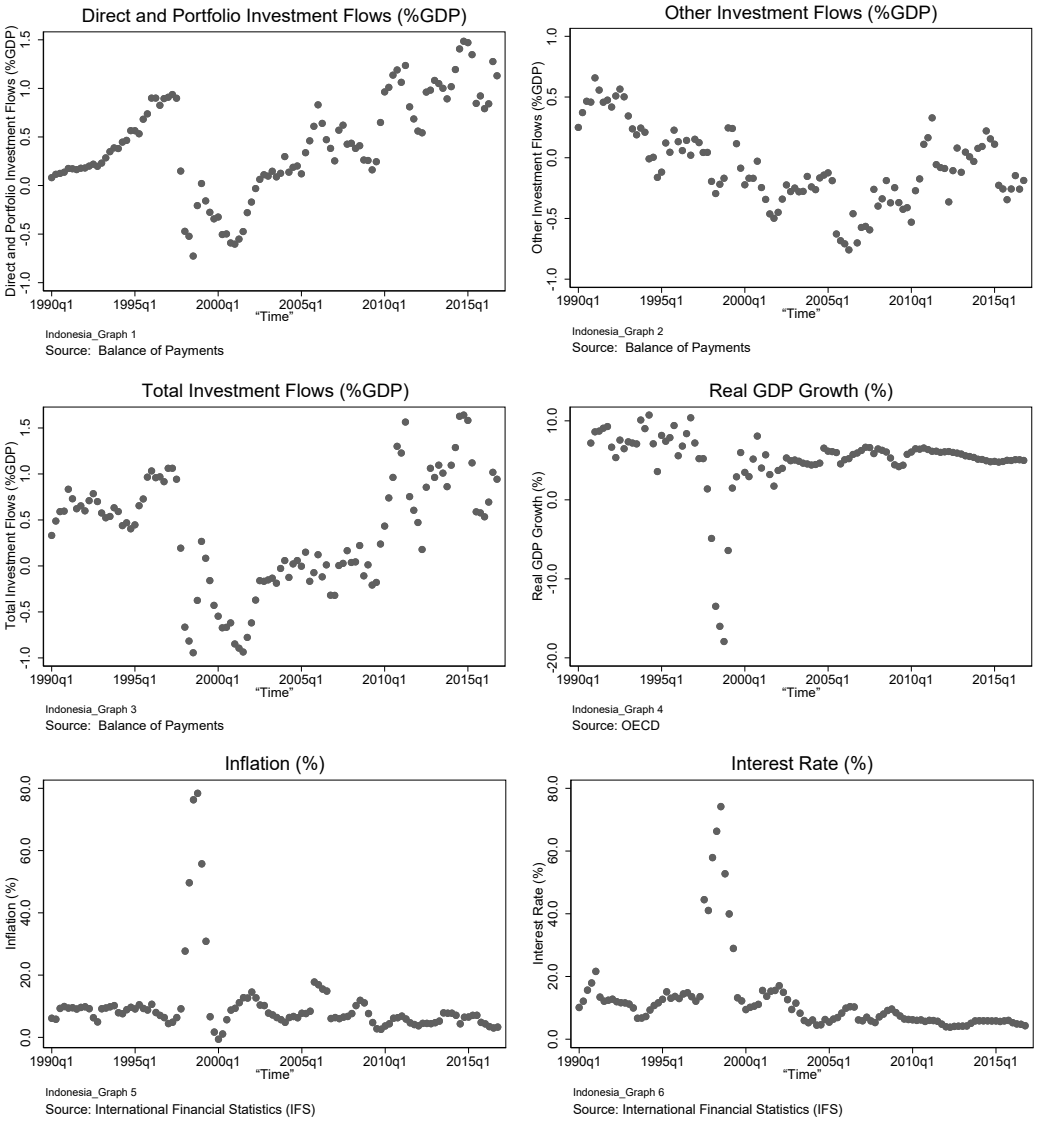
Two-Country SVAR Model: Indonesia-Japan, 1996-2016

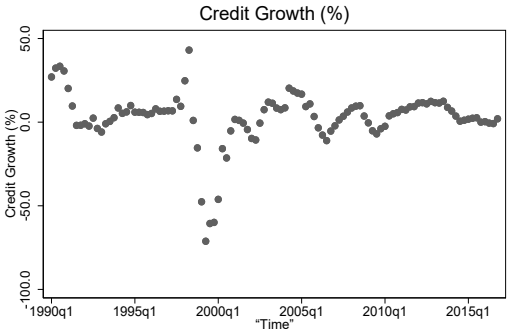
Equation	χ^2	Prob>χ^2
Aggregate Investment Flows		
Aggregate Investment Flows	191.60	0.00
GDP Growth	962.13	0.00
Inflation	708.84	0.00
Interest Rates	209.12	0.00
Exchange Rates	509.58	0.00
Direct & Portfolio Investment Flows		
Direct & Portfolio Investment Flows	206.20	0.00
GDP Growth	1046.10	0.00
Inflation	538.92	0.00
Interest Rates	214.98	0.00
Exchange Rates	514.21	0.00
Other Investment Flows		
Other Investment Flows	133.27	0.00
GDP Growth	877.22	0.00
Inflation	588.14	0.00
Interest Rates	233.52	0.00
Exchange Rates	542.92	0.00

Single-Country SVAR Model, 1990-2016

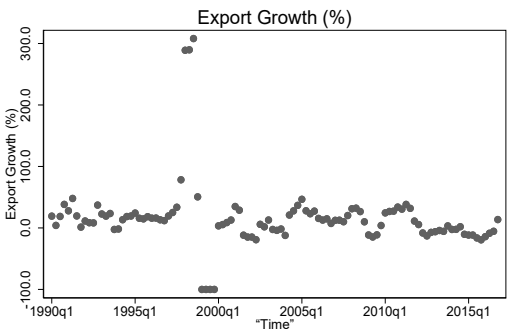
Equation	χ^2	Prob>χ^2
Aggregate Investment Flows		
GDP Growth	341.48	0.00
Inflation	448.04	0.00
Interest Rates	165.62	0.00
Credit Growth	466.18	0.00
Exchange Rates	533.90	0.00
Direct & Portfolio Investment Flows		
GDP Growth	378.37	0.00
Inflation	517.67	0.00
Interest Rates	169.26	0.00
Credit Growth	480.24	0.00
Exchange Rates	540.55	0.00
Other Investment Flows		
GDP Growth	389.35	0.00
Inflation	499.68	0.00
Interest Rates	159.54	0.00
Credit Growth	465.22	0.00
Exchange Rates	519.63	0.00

Figure A3-1. Data Plot of the Indonesia's Variables

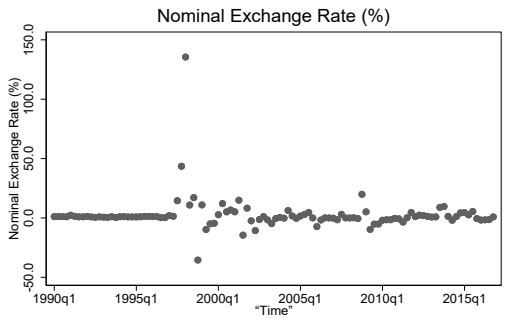




Indonesia_Graph 7
Source: Bank for International Settlements (BIS)

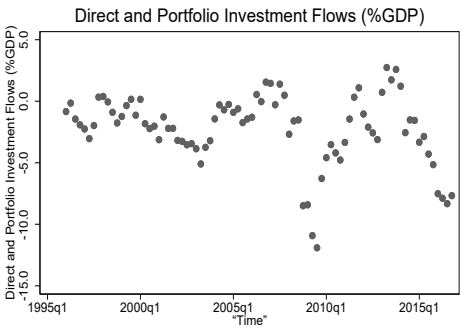


Indonesia_Graph 8
Source: International Financial Statistics (IFS)

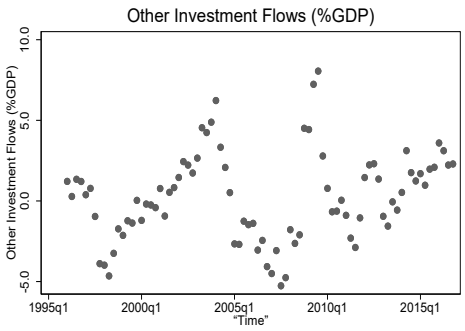


Indonesia_Graph 9
Source: Federal Reserve Bank of St. Louis (FRED)

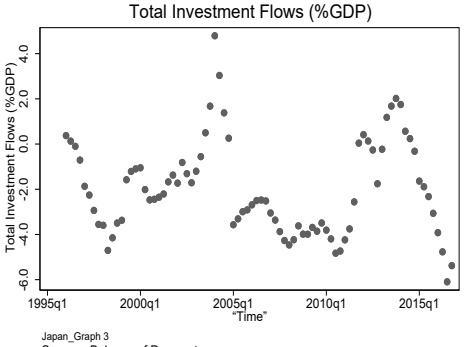
Figure A3-2. Data Plot of the Japan's Variables



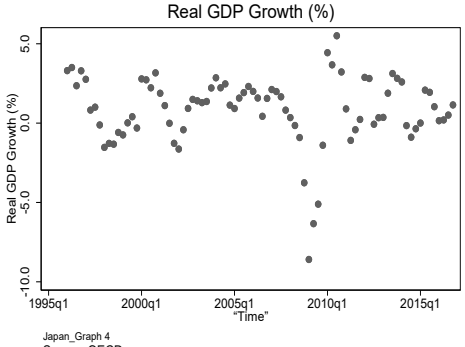
Japan_Graph 1
Source: Balance of Payments



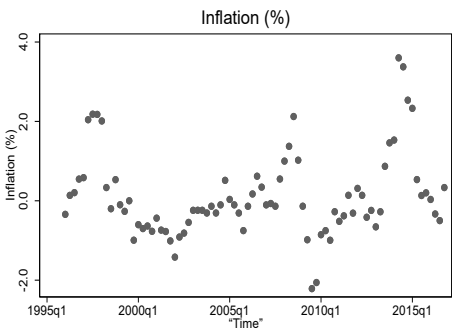
Japan_Graph 2
Source: Balance of Payments



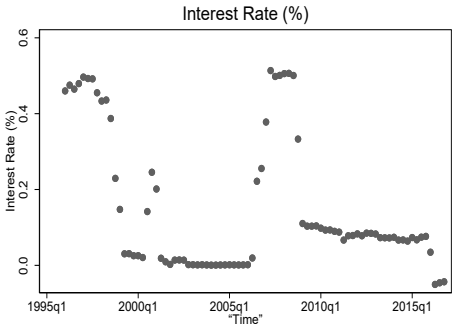
Japan_Graph 3
Source: Balance of Payments



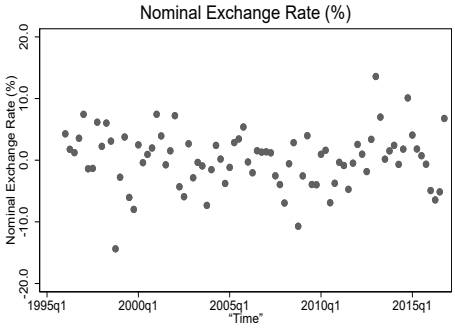
Japan_Graph 4
Source: OECD



Japan_Graph 5
Source: International Financial Statistics (IFS)

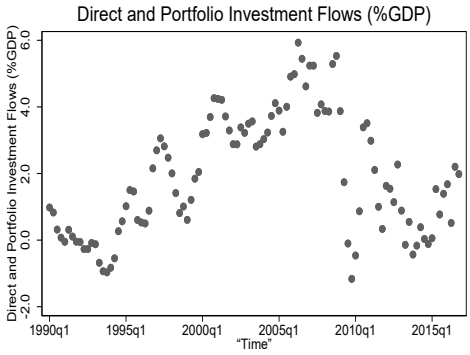


Japan_Graph 6
Source: International Financial Statistics (IFS)

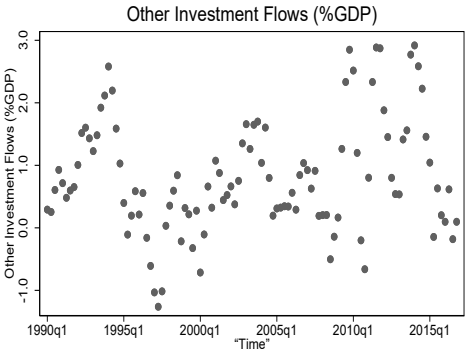


Japan_Graph 7
Source: Federal Reserve Bank of St. Louis (FRED)

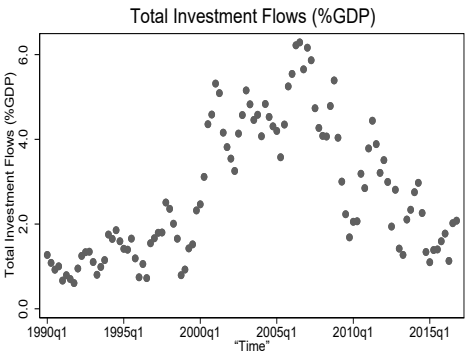
Figure A3-3. Data Plot of the US's Variables



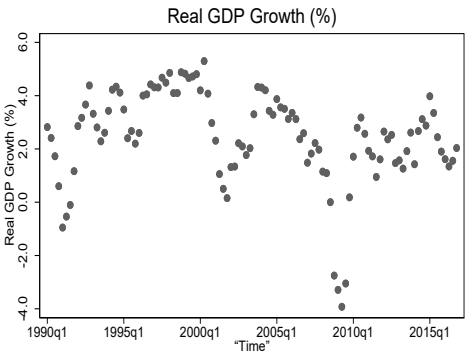
US_Graph 1
Source: Balance of Payments



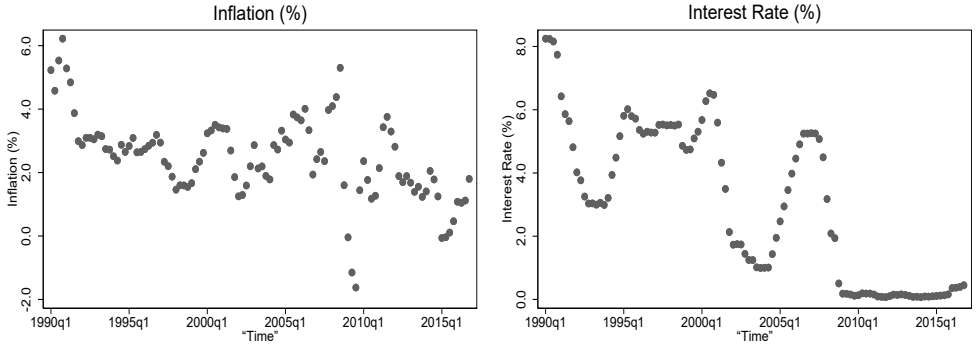
US_Graph 2
Source: Balance of Payments



US_Graph 3
Source: Balance of Payments



US_Graph 4
Source: OECD



Appendix 3: Tables of Chapter 4

Table A4-1. List of Countries and IT Adoption Dates (Chapter 4)

No	Advanced Economies	IT Adoption Date	No	Emerging Economies	IT Adoption Date
1	Australia	1993	1	Armenia	2006
2	Canada	1991	2	Brazil	1999
3	Japan	2013	3	Chile	1999
4	Korea	2000	4	Colombia	1999
5	New Zealand	1990	5	Czech Republic	1997
6	Norway	2001	6	Dominican Republic	2012
7	Russia	2015	7	Georgia	2009
8	Sweden	1993	8	Ghana	2007
9	United Kingdom	1992	9	Hungary	2001
10	United States	1996	10	India	2015
			11	Indonesia	2005
			12	Israel	1997
			13	Mexico	2001
			14	Moldova	2013
			15	Paraguay	2011
			16	Peru	2002
			17	Philippines	2002
			18	Poland	1999
			19	Romania	2005
			20	South Africa	2000
			21	Thailand	2000
			22	Turkey	2006
			23	Uganda	2011
			24	Uruguay	2007

Source: BIS, central bank website.

Table A4-2. Summary Statistics of the Taylor Rule Indicators (Chapter 4)

Variable	All Economies					Advanced Economies					Emerging Economies				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Policy Rates	558	5.45	4.30	-0.50	26.00	206	3.45	2.56	-0.50	11.25	352	6.62	4.66	0.05	26.00
Inflation Gap	559	0.51	2.36	-6.94	14.25	206	-0.08	1.39	-2.49	11.53	353	0.85	2.72	-6.94	14.25
GDP Gap	559	0.001	0.10	-0.31	0.73	206	-0.004	0.06	-0.21	0.19	353	0.004	0.12	-0.31	0.73
REER Gap	559	-0.22	6.26	-23.52	23.46	206	-0.44	6.41	-17.56	23.46	353	-0.09	6.18	-23.52	18.67
Capital Inflows	547	5.91	5.83	-48.28	51.51	196	6.74	5.09	-3.58	25.03	351	5.44	6.16	-48.28	51.51
Capital Outflows	524	3.86	6.72	-51.57	53.54	196	6.44	6.61	-6.75	38.09	328	2.32	6.31	-51.57	53.54
Fed Funds Rate	559	1.77	1.99	0.07	7.31	206	2.30	2.18	0.07	7.31	353	1.46	1.81	0.07	6.4
VIX	559	19.62	6.78	11.04	40.00	206	19.57	6.69	11.04	40.00	353	19.66	6.84	11.04	40.00

Table A4-3. Capital Flows Thresholds using the 10th & 90th Percentile

	Capital Inflows					Capital Outflows				
	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf. Interval]		Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf. Interval]	
All Economies	547	10	1.92	1.67	2.22	524	10	0.12	-0.03	0.24
		90	10.51	9.69	11.75		90	9.96	8.32	12
Advanced Economies	196	10	2	0.76	2.4	196	10	0.82	-0.08	1.51
		90	13.38	10.69	17.32		90	16.29	13.12	18.67
Emerging Economies	351	10	1.86	1.63	2.12	328	10	0.06	-0.09	0.15
		90	9.53	8.87	10.37		90	5.48	4.56	6.63

Table A4-4. Capital Flows Thresholds using the 5th & 95th Percentile

	Capital Inflows					Capital Outflows				
	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf. Interval]		Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf. Interval]	
All Economies	547	5	0.95	-0.23	1.54	524	5	-0.38	-1.35	-0.05
		95	13.48	11.99	15.05		95	15.4	12.51	17.83
Advanced Economies	196	5	-0.28	-2.07	1.82	196	5	-0.44	-3.58	0.54
		95	18.72	13.51	21.62		95	20.35	17.07	22.63
Emerging Economies	351	5	1.10	0.03	1.67	328	5	-0.29	-1.72	-0.05
		95	11.49	10.09	13.21		95	7.84	6.57	11.29

Table A4-5. Joint Significance Test Results for the Augmented Taylor Rule Models

Capital Inflows	Emerging Economies				Advanced Economies				All Economies			
	Non-thresholds models											
	Model 3	**Model 4*)**	**Model 5**	**Model 6**	**Model 3**	**Model 4*)**	**Model 5**	**Model 6**	**Model 3**	**Model 4*)**	**Model 5**	**Model 6**
Wald χ^2	173.59	546.49	291.66	515.51	1461.07	1412.88	306115.41	264304.39	203.72	246.37	562.95	648.89
Prob > χ^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Thresholds models (extreme periods)											
	Model 7	**Model 8*)**	**Model 9**	**Model 10**	**Model 7**	**Model 8*)**	**Model 9**	**Model 10**	**Model 7**	**Model 8*)**	**Model 9**	**Model 10**
Wald χ^2	128.55	174.42	203.52	256.16	2069.89	2140.81	3214.76	4715.16	216.12	238.76	525.37	527.82
Prob > χ^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Thresholds models (normal periods)											
	Model 11	**Model 12*)**	**Model 13**	**Model 14**	**Model 11**	**Model 12*)**	**Model 13**	**Model 14**	**Model 11**	**Model 12*)**	**Model 13**	**Model 14**
Wald χ^2	151.52	315.39	305.35	498.94	1995.71	2389.95	3296.36	5786.47	214.44	238.06	600.74	623.90
Prob > χ^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Capital Outflows	Emerging Economies				Advanced Economies				All Economies			
	Non-thresholds models											
	Model 3	**Model 4*)**	**Model 5**	**Model 6**	**Model 3**	**Model 4*)**	**Model 5**	**Model 6**	**Model 3**	**Model 4*)**	**Model 5**	**Model 6**
Wald χ^2	210.57	668.41	534.07	1001.12	11015.35	11872.10	23524.70	26903.28	240.20	336.22	753.54	727.09
Prob > χ^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Thresholds models (extreme periods)											
Wald χ^2	**Model 7**	**Model 8*)**	**Model 9**	**Model 10**	**Model 7**	**Model 8*)**	**Model 9**	**Model 10**	**Model 7**	**Model 8*)**	**Model 9**	**Model 10**
Prob > χ^2	166.17	382.30	449.29	489.61	1658.92	2832.41	2912.49	3079.72	226.02	258.96	544.84	506.11
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Thresholds models (normal periods)											
Wald χ^2	**Model 11**	**Model 12*)**	**Model 13**	**Model 14**	**Model 11**	**Model 12*)**	**Model 13**	**Model 14**	**Model 11**	**Model 12*)**	**Model 13**	**Model 14**
Prob > χ^2	162.52	432.13	457.93	475.44	2530.29	4008.08	3882.92	4894.52	213.21	252.05	578.92	540.97
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: *) the preferred augmented Taylor rule based on Taylor (2001) that is extended by capital flows dynamics.

Table A4-6. Taylor Rule Estimation Results beyond Capital Inflows Threshold Bands: Robustness Check

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 7	Model 8	Model 9	Model 10	Model 7	Model 8	Model 9	Model 10	Model 7	Model 8	Model 9	Model 10
Lag.Policy Rates	0.523***	0.515***	0.407***	0.401***	0.795***	0.793***	0.572***	0.573***	0.593***	0.588***	0.436***	0.432***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.03)	(0.03)	(0.06)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.469***	0.423***	0.468***	0.399***	-0.058	-0.045	0.119	0.116	0.392***	0.366***	0.446***	0.415***
	(0.12)	(0.11)	(0.11)	(0.10)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	1.977**	3.924***	-0.051	1.855	4.083***	3.914***	1.005	1.041	2.580***	3.613***	0.423	1.380
	(0.90)	(0.95)	(1.17)	(1.23)	(0.76)	(0.72)	(1.04)	(1.06)	(0.78)	(0.87)	(0.99)	(1.11)
REER Gap		-0.096***		-0.098***		0.006		-0.001		-0.049**		-0.047**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.022***	0.022***	0.022***	0.021***	-0.004	-0.004	-0.003	-0.003	0.023***	0.024***	0.019***	0.019***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.422***	0.408***			0.403***	0.403***			0.436***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.07)
VIX Index			0.043**	0.057***			-0.026***	-0.026***			0.017	0.020
			(0.02)	(0.02)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.509***	2.579***	1.901***	1.704***	0.458***	0.468***	0.888***	0.888***	1.769***	1.793***	1.568***	1.538***
	(0.55)	(0.59)	(0.56)	(0.60)	(0.11)	(0.12)	(0.24)	(0.24)	(0.37)	(0.38)	(0.36)	(0.36)
Observations	302	302	302	302	177	177	177	177	479	479	479	479

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively.

All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance.

Table A4-7. Taylor Rule Estimation Results within Capital Inflows Threshold Bands: Robustness Check

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Lag Policy Rates	0.521***	0.514***	0.406***	0.401***	0.788***	0.786***	0.565***	0.565***	0.591***	0.587***	0.435***	0.431***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.470***	0.423***	0.468***	0.398***	-0.037	-0.023	0.135	0.134	0.394***	0.367***	0.444***	0.412***
	(0.12)	(0.11)	(0.11)	(0.10)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.09)
GDP Gap	1.991**	3.925***	-0.024	1.876	3.426***	3.248***	0.447	0.469	2.555***	3.573***	0.367	1.316
	(0.89)	(0.95)	(1.16)	(1.23)	(0.65)	(0.61)	(0.95)	(1.01)	(0.77)	(0.86)	(0.98)	(1.10)
REER Gap		-0.096***		-0.099***		0.006		-0.001		-0.049**		-0.047**
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Inflows	0.023***	0.024***	0.020***	0.022***	0.031*	0.031*	0.026	0.026	0.029***	0.030***	0.024***	0.025***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.419***	0.405***			0.403***	0.403***			0.436***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.044**	0.058***			-0.025***	-0.025***			0.018	0.021
			(0.02)	(0.02)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.408***	2.475***	1.797***	1.588***	0.269***	0.280***	0.710***	0.710***	1.630***	1.641***	1.424***	1.381***
	(0.55)	(0.58)	(0.57)	(0.59)	(0.07)	(0.08)	(0.19)	(0.19)	(0.37)	(0.38)	(0.35)	(0.35)
Observations	302	302	302	302	177	177	177	177	479	479	479	479

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively.

All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance.

Table A4-8. Taylor Rule Estimation Results beyond Capital Outflows Threshold Bands: Robustness Check

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 7	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 7**	**Model 8**	**Model 9**	**Model 10**
Lag Policy Rates	0.552***	0.538***	0.410***	0.399***	0.787***	0.784***	0.572***	0.573***	0.619***	0.611***	0.448***	0.440***
	(0.08)	(0.07)	(0.09)	(0.08)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.452***	0.418***	0.464***	0.414***	-0.041	-0.026	0.122	0.120	0.360***	0.346***	0.429***	0.413***
	(0.13)	(0.12)	(0.12)	(0.11)	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.433*	3.070***	-0.928	0.690	3.292***	3.088***	0.908	0.940	1.979**	2.779***	-0.265	0.412
	(0.83)	(0.86)	(0.99)	(1.07)	(0.86)	(0.74)	(1.00)	(1.02)	(0.81)	(0.84)	(0.90)	(0.95)
REER Gap		-0.077***		-0.077***		0.007		-0.001		-0.036**		-0.032*
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Outflows	0.018***	0.017***	0.016***	0.015***	0.027***	0.028***	0.003	0.003	0.030***	0.030***	0.021***	0.022***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)
Fed Fund Rate			0.443***	0.435***			0.400***	0.400***			0.437***	0.441***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.052***	0.062***			-0.027***	-0.027***			0.021*	0.022*
			(0.02)	(0.01)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.236***	2.332***	1.513***	1.425***	0.456***	0.468***	0.894***	0.894***	1.565***	1.604***	1.308***	1.314***
	(0.51)	(0.55)	(0.47)	(0.53)	(0.11)	(0.11)	(0.24)	(0.24)	(0.33)	(0.34)	(0.28)	(0.30)
Observations	282	282	282	282	177	177	177	177	459	459	459	459

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively.

All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance.

Table A4-9. Taylor Rule Estimation Results within Capital Outflows Threshold Bands: Robustness Check

Variable	Emerging Economies				Advanced Economies				All Economies			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Lag Policy Rates	0.552***	0.539***	0.411***	0.399***	0.766***	0.765***	0.561***	0.562***	0.620***	0.612***	0.449***	0.441***
	(0.08)	(0.07)	(0.09)	(0.08)	(0.02)	(0.02)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Inflation Gap	0.453***	0.419***	0.464***	0.414***	-0.002	0.011	0.148	0.146	0.362***	0.349***	0.429***	0.414***
	(0.13)	(0.12)	(0.12)	(0.11)	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.10)
GDP Gap	1.460*	3.091***	-0.897	0.717	2.791***	2.620***	0.334	0.363	1.961**	2.753***	-0.270	0.403
	(0.84)	(0.86)	(0.99)	(1.07)	(0.94)	(0.83)	(1.04)	(1.08)	(0.81)	(0.84)	(0.90)	(0.95)
REER Gap		-0.077***		-0.077***		0.006		-0.001		-0.035**		-0.031*
		(0.02)		(0.02)		(0.01)		(0.01)		(0.02)		(0.02)
Capital Outflows	0.021***	0.019***	0.018***	0.017***	0.044***	0.044***	0.025***	0.025***	0.035**	0.035**	0.024***	0.024***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Fed Fund Rate			0.441***	0.433***			0.393***	0.393***			0.435***	0.439***
			(0.10)	(0.10)			(0.05)	(0.05)			(0.07)	(0.06)
VIX Index			0.053***	0.063***			-0.026***	-0.026***			0.022*	0.023*
			(0.02)	(0.01)			(0.01)	(0.01)			(0.01)	(0.01)
Constant	2.193***	2.293***	1.466***	1.382***	0.270**	0.280**	0.778***	0.778***	1.452***	1.491***	1.215***	1.222***
	(0.51)	(0.55)	(0.47)	(0.53)	(0.11)	(0.12)	(0.22)	(0.22)	(0.34)	(0.35)	(0.28)	(0.29)
Observations	282	282	282	282	177	177	177	177	459	459	459	459

Notes: Numbers in parentheses report the standard errors. *, **, *** indicate the statistical significance at the 10%, 5%, and 1% respectively.

All models are estimated with robust standard errors and passed the overidentifying restrictions test at the 1% level of significance.